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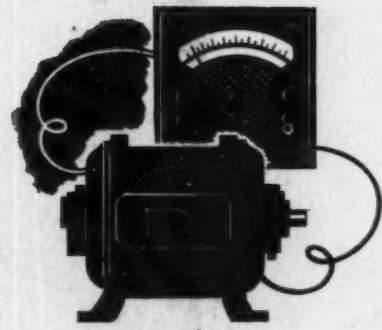
Agr. Engr.

*Maintenance
Section*

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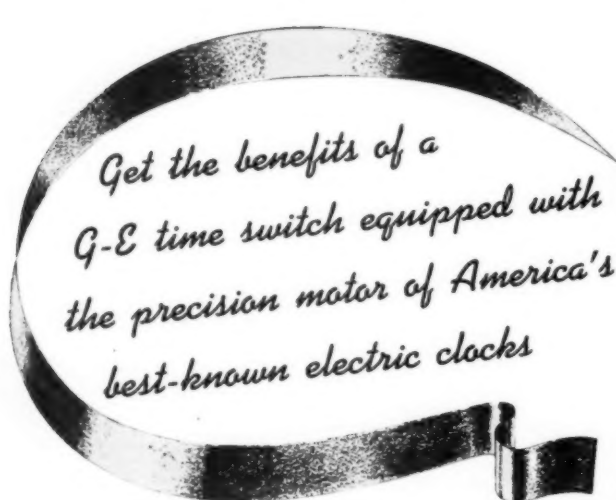
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electrical contracting



AUGUST • 1939

It's the Only General-Purpose Time Switch with Telechron Motor Drive

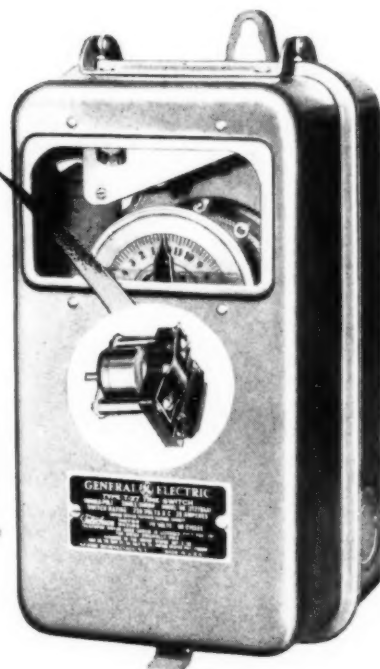


WHEN it comes to reliability—the kind of performance that protects your profits and satisfies your customers—a time switch is only as dependable as the motor that drives it.

That's why we build G-E time switches with Telechron motors. These motors are sealed in oil for quietness and long life; they're universally recognized for sturdy, day-after-day performance. And as for customer acceptance, almost a million of them were assembled in electric clocks last year alone. It's Telechron motor drive in G-E time switches that provides accurate timing, turns circuits on or off exactly when required, keeps power bills low. Its reputation can help you sell.

Other features add to the preference for G-E time switches, too. They're built for maintenance-free per-

General-purpose
Type T-27



formance. Not only does the reliability of the drive avoid costly service calls, but quick-make, quick-break solid-silver contacts, *conservatively* rated at 35 amperes, offer added protection. Finally, from your own angle, G-E time switches are easy to wire. Just take a look at the space below the terminal block—notice the convenience of the five standard knockouts.

You can get further details by calling the nearest G-E office or by writing for Bulletin GEA-1427H. General Electric, Schenectady, N. Y.



SILVER CONTACTS—G-E time switches have silver-to-silver, self-aligning, self-cleaning contacts that resist oxidation. Quick-acting, extra-strong contact springs maintain positive contact and resist severe vibration.



G-E MONOGRAM—The fact that it's a G-E time switch means readier acceptance of your wiring bid. The G-E monogram on thousands of products has become a symbol of reliability. Customers know it means dependable service.

GENERAL ELECTRIC

440-122

*Easy installation made it
the favorite overnight!*

Down in the lower right corner—one of a line of complete cabinets (service and range switches) which shows the simplicity of design. The larger picture is of the Bakelite pull-out switch interior itself, which, due to its unique conception, eliminates many electrical joints, formerly regarded as unavoidable.

Installation is about as easy as saying that you merely hang the cabinet, connect the service wires and forget it. Send the coupon for the full facts. You'll want all the "dope" on this brand new, widely approved, service wiring development. Metropolitan Device Corp., Brooklyn, N. Y.

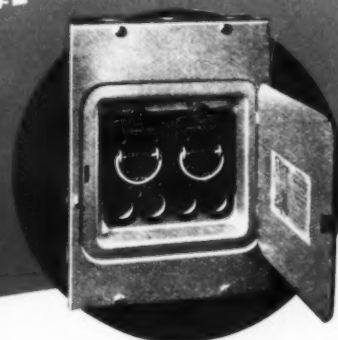
Murray

SERVICE and RANGE EQUIPMENT

IT'S BAKELITE



Send coupon



**METROPOLITAN
DEVICE CORPORATION
BROOKLYN, N. Y.**

Please send detailed information on
Murray Service & Range Equipments.

Name.....

Company.....

Address.....

CAN YOU MAKE MONEY PUTTING IN THE LOWEST BID?



Too often the jobs let on the lowest bid are the most expensive in the long run. They do neither the customer nor the contractor justice. The customer pays in maintenance and replacement—the contractor loses his shirt...and his customer.

The real cream of the contracting business goes to the contractor who knows and tells his customers that money saving features cost them less in the long run. Note these features in the Westinghouse Packaged Control line—features that help take you out of low-priced competition.



Westinghouse Nofuze Circuit Breaker SAVES UP TO \$3000 A YEAR

Every motor circuit in a large railroad shop is now Nofuze protected. Savings on cost of replacement fuses alone total more than \$400 a year—plus many times more than this in the cost of idle men and machines due to fuse outages.

“We used to carry a pocketful of fuses around with us” reports one Illinois manufacturer. “Machines were continually stopping, men were idle until fuses were replaced.” The cost of these delays is eliminated with NOFUZE protection.

A clay plant in Illinois reports savings of \$18.00 a day—over \$3000 a year...similarly from all over the country, manufacturers report savings.

Recommend Nofuze Circuit Breakers to your customers bothered with fuse outages and make them your customers—permanently.

Westinghouse





Westinghouse Safety Switches THREE EXTRAS THAT CUT OPER- ATING COSTS

1. The diamond pointed jaw and extended blade confine the arc to non-current carrying areas, leaving contact areas clean and free from beading.
2. One piece copper parts make fewer connecting points, mean less heat loss, less waste of power. Westinghouse switches have fewer connecting points than any other switch.
3. In 575 and 600 volt ratings, "De-ion" grids — quench arcs immediately, prevent flashovers, prolong contact life.

Westinghouse Combination Linestarter

1 PACKAGED UNIT DOES 4 JOBS

Costs less to install. Saves wire, conduit, labor. The Westinghouse Combination Linestarter combines these four jobs in one compact package;

1. Magnetic Motor Starter.
2. Manual Disconnect Switch.
3. Motor Overload Protection.
4. Nofuze Circuit Breaker.



J-20838

New "De-ion" Motor Watchman SAVES REPAIR BILLS...

- Automatically cuts the motor from the line before overload can damage windings.

- Westinghouse bi-metal disc gives positive, certain protection.

- Toggle switch indicates whether starter is on, off or tripped.

- "De-ion" arc quenchers prevent flashovers...prolong contact life.

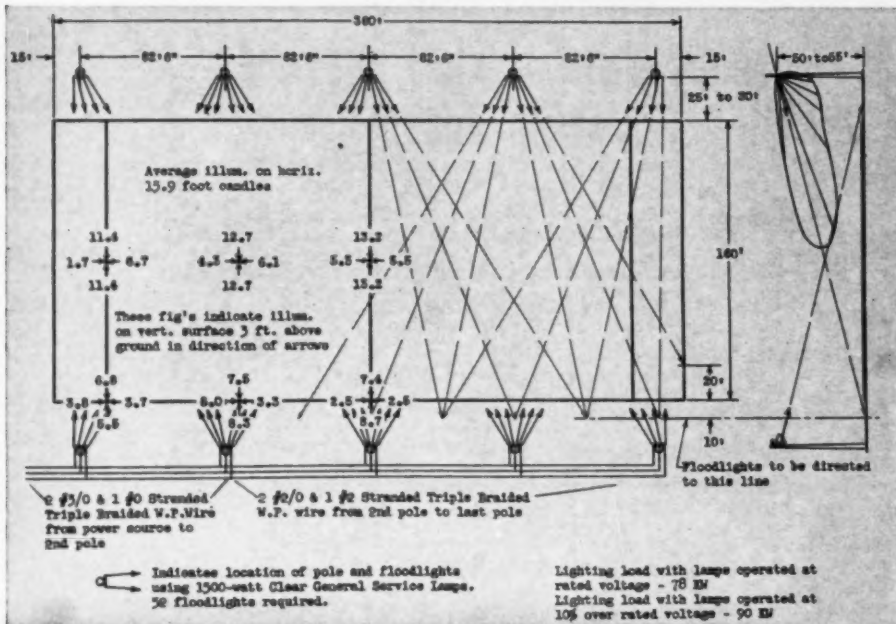
Call your nearest Westinghouse distributor for sizes, types, prices. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



Packaged Control

School Officials Want to Know How to Light Football Fields

To Attract More Spectators and Provide Better Playing Conditions



THIS FREE MANUAL SHOWS HOW!

Free to Electrical Contractors to help you sell Approved Benjamin Quality Floodlighting Jobs this Fall

With this Benjamin Manual you can show school officials proof of the success of night football—show how educators and coaches alike are unanimous in their approval. In this Manual are contained the experiences of many schools with Benjamin Floodlighting, experiences which show that Floodlighting has increased attendance 50% to as high as 300% and has infused new spirit into the students, alumni and townspeople.

Floodlighting Must Insure Spectator Enjoyment of Game

By using this Manual you can show that the enjoyment of spectators depends largely on whether they can clearly and easily see to follow the play on the field. You can demonstrate how Benjamin's unique method of floodlighting best meets the important key requirement of correct football field lighting, by providing exceptional light not only on the horizontal ground surface but, what is more important, on the vertical surfaces, the front, back and the sides of the players and all faces of the ball.

Floodlighting Must Do a Double Purpose Job

Thus you can show how Benjamin lighting serves the double purpose of providing better playing conditions for the players and at the same time adding to the enjoyment of the spectators by making every action of the game easy to follow from every location in the stands.

The Lighting layout illustrated on this page is one of the many outstanding plans developed by Benjamin Illuminating Engineers and is included with many others in the new Benjamin Football Lighting Manual.

You will find these layouts of real practical value in showing school officials how to light their football fields to attract more spectators and provide better playing conditions. Besides the Lighting layouts, the Manual contains valuable information on the proper installation of floodlights including pole details, wiring diagrams, aiming charts, etc., to help engineer the job. Also included are principles of illumination design as well as answers to practically every important question on football field lighting. Mail the Coupon today . . . get prepared to go after those football floodlighting jobs right now. The services of your local Benjamin wholesaler and the Benjamin Engineering Department are available to you without cost or obligation. Includes valuable "How to Do It" details. Act now. Mail coupon or address the Benjamin Electric Mfg. Co., Des Plaines, Ill.



THE KEY TO CORRECT FOOTBALL
FIELD LIGHTING IS TO MAKE

THE **PLAYERS** AND THE **BALL**

ALWAYS VISIBLE

...THIS FREE MANUAL
SHOWS HOW!

BENJAMIN

LIGHTING EQUIPMENT

Distributed Exclusively Through Electrical Wholesalers

Benjamin Electric Mfg. Co., Des Plaines, Ill.

☐ Send me a copy of the NEW BENJAMIN FOOTBALL FLOODLIGHTING MANUAL

☐ One of our local schools is considering football floodlighting please tell me how your engineering department can help

Name

Address

City

State

Electrical Contracting

With which is consolidated The
Electrict and Electrical Record
Established 1901

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McGraw-Hill Publishing Company, Inc.

JAMES H. McGRAW, Founder and Honorary Chairman

Publication Office, 99-129 North Broadway, Albany, N. Y.

Editorial and Executive Offices, 330 W. 42nd St., New York, N. Y.

JAMES H. McGRAW, JR.

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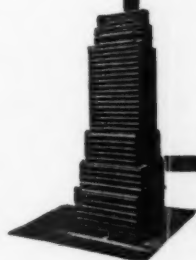
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Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta. Published monthly, price 25 cents a copy. Vol. 38, No. 8. Subscription rates: U. S., Canada, and Latin-American republics, \$2 a year; all other countries, \$3.00 a year. Entered as second-class matter August 29, 1936, at Post-office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. Copyright 1939, by McGraw-Hill Publishing Company. Cable address: "McGrawhill, New York." Member A.B.P. Member A.B.C.

A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, and residential.



Canopy Pull Switches

new

number
ARROW 450

P
U
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Any way you look at it, this new switch has features you *want*:—its design follows a persistent market-demand.

Its compact size and shallow base make it just right for shallow ceiling units. *Only $\frac{3}{16}$ " deep!*

The easy, quiet action of the mechanism bespeaks a switch of Quality and Durability. Pull chain has a special stop to prevent breakage by extra-hard pulls.

The "works" are enclosed in brass shell, with 6" wire leads secured in Bakelite section. Rated 3 Amps., 125 V., 1 Amp., 250 V. Listed as standard by Underwriters Laboratories... And *competitively priced* for large-volume SALES.

SOLD THROUGH YOUR

ARROW ELECTRIC DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

ELECTRICAL WHOLESALER

AUGUST, 1939

Hercules is Dead

YOU WILL REMEMBER THE STORY about Kid Hercules, the one time heavy weight champ of Mt. Olympus. The goddess Juno was griped with him, because her husband Jupiter had sired him without her assistance. So she gave young Hercules twelve chores to do.

CHORE NO. 5 WAS TO CLEAN OUT the Augean stables. This barn sheltered 3,000 oxen and no dung had been pitched from any stall for 30 years. But did our hero call the W.P.A.? He pushed over the rivers Altheus and Peneus, ran 'em right through the stable, and the job was done.

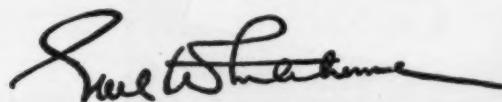
OF COURSE, WE ALL SHOUT "ATTA BOY!" at such a tale. But wait a minute! We have a stable of our own in the electrical industry that needs some pitchfork work—maybe. We know it. But most of us just say—"Why doesn't somebody clean up this mess?" We forget that Hercules is dead.

NOW FOR EXAMPLE—JUST TO TAKE ONE STALL. Many contractors are complaining of the unfair competition that is growing out of the misuse of protection contracts. The trouble comes because some contractors order double the quantity the job requires. Or more than that. And the manufacturer and wholesaler fall for it.

BUT THE PURPOSE OF A PROTECTION CONTRACT, I take it, is to guarantee quotations given when the bids are put in for a specific job. The manufacturer guarantees the price. The contractor agrees to buy that brand of wire or pipe. To up the quantity is simply to sneak in some extra cars of low priced wire or pipe to use in competing against other contractors for other business.

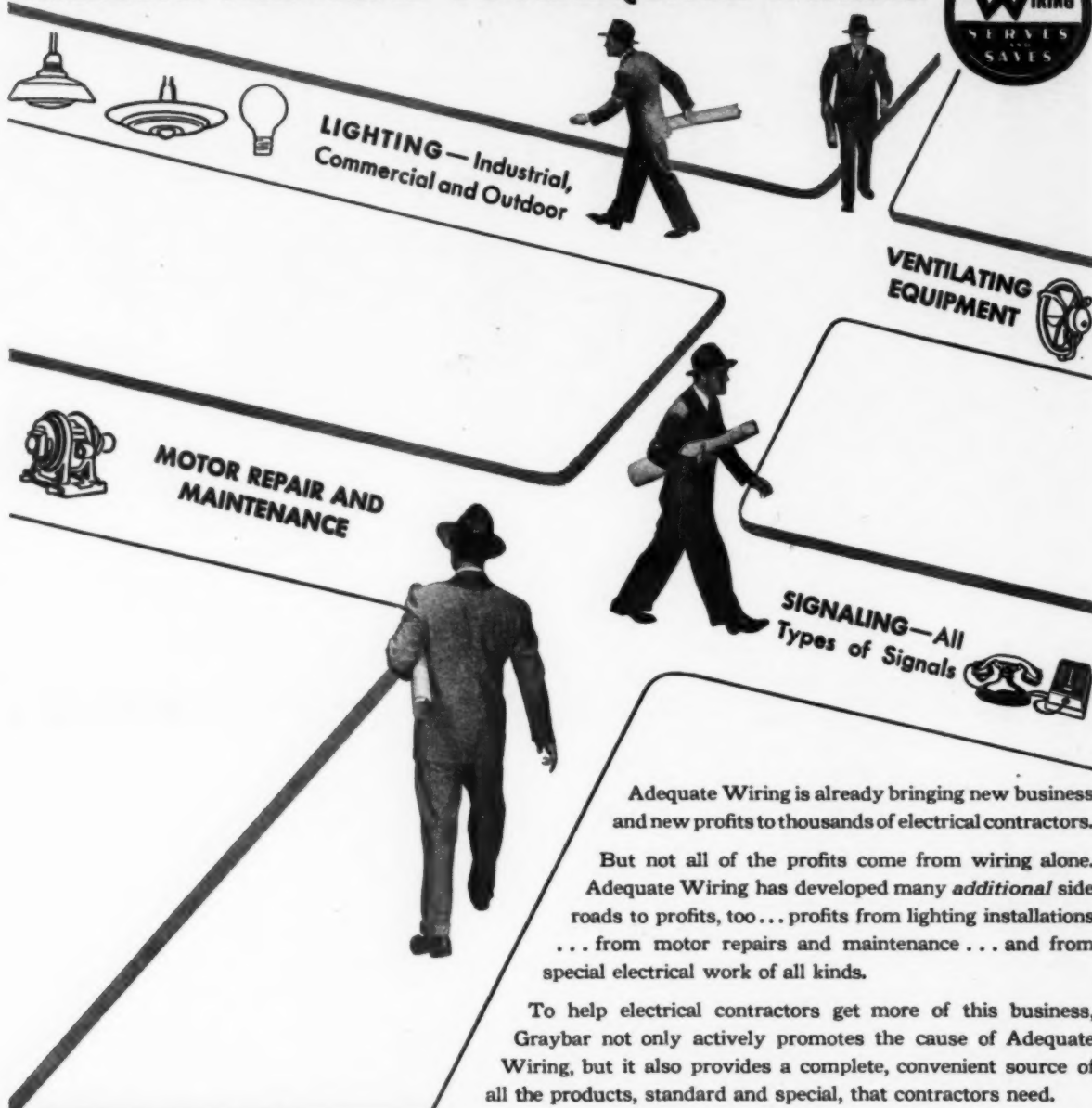
A SMALL MATTER—AND SMART? No! Not smart. Not honest. For when any contractor orders an extra quantity delivered to a job, so he can truck it home to use against competitors, it is sharp practice. In fact, it is legally a fraud. And conduit and wire are the bone and sinew of electrical construction.

WIRE AND CONDUIT ARE SICK. We know the story. No money is made on them. But insofar as concerns the evil that comes from this extra wire and pipe, bootlegged through protection contracts, we cause the grief. And we need not wait for Hercules. We can cure this trouble for ourselves. We can establish cooperatively in each city, some one to check the quantities for the wholesalers on all protection contracts.



EXTRA PROFITS AT EVERY TURN

...ALONG THE ROAD TO ADEQUATE WIRING



Adequate Wiring is already bringing new business and new profits to thousands of electrical contractors.

But not all of the profits come from wiring alone. Adequate Wiring has developed many *additional* side roads to profits, too... profits from lighting installations ... from motor repairs and maintenance ... and from special electrical work of all kinds.

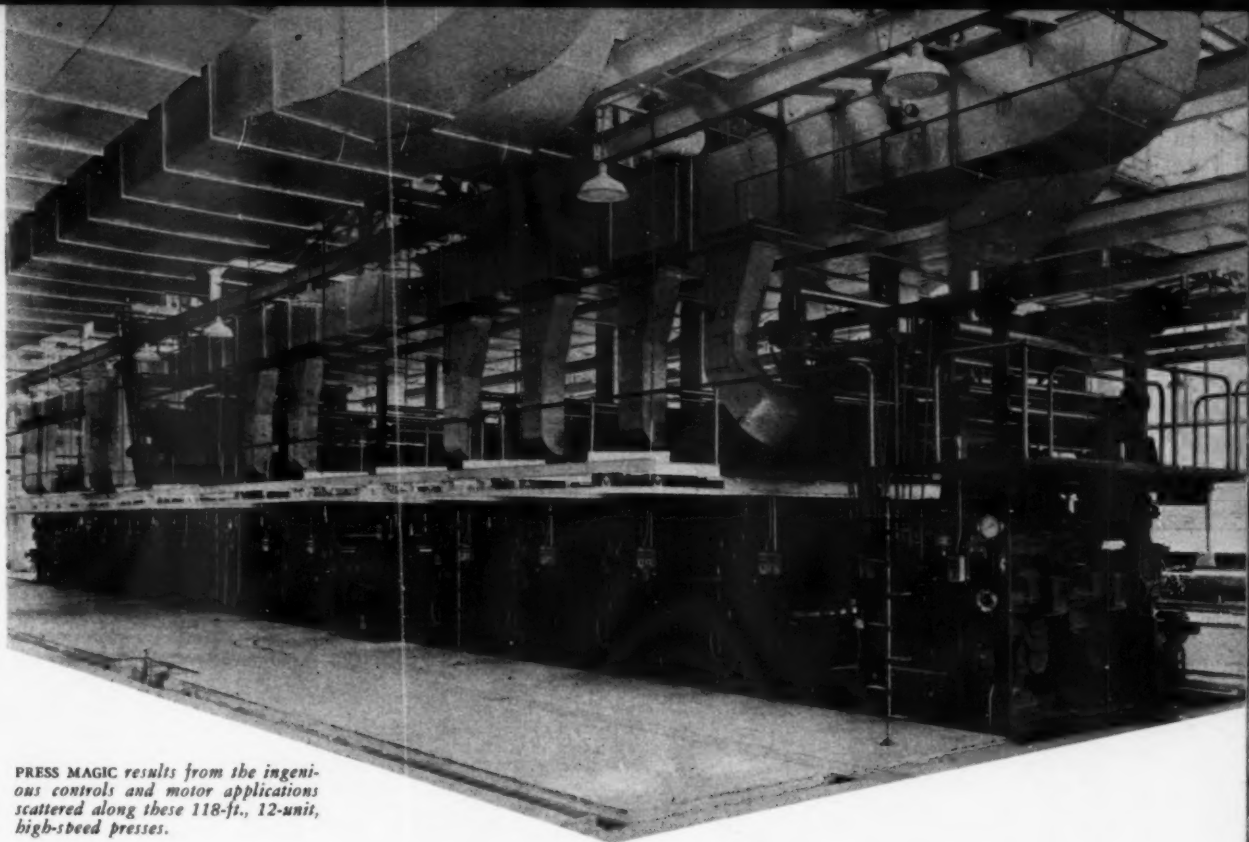
To help electrical contractors get more of this business, Graybar not only actively promotes the cause of Adequate Wiring, but it also provides a complete, convenient source of all the products, standard and special, that contractors need.

Electrical contractors will find that Graybar's prompt "action service" brings what you want, when and where you want it. And back of every sale and item stands a solid Graybar guarantee.

Make Graybar your Adequate Wiring supplies headquarters and also headquarters for motors and control, lighting equipment, signaling equipment and ventilation items.



OFFICES IN 83 PRINCIPAL CITIES—EXECUTIVE OFFICES, GRAYBAR BUILDING, NEW YORK



PRESS MAGIC results from the ingenious controls and motor applications scattered along these 118-ft., 12-unit, high-speed presses.

This Plant Gets the Facts

Wiring for the world's largest rotogravure plant was designed to simplify checking production costs.

COMPETITION is keen in the mass production of printing. Therefore, costs must be controlled within extremely narrow limits in handling orders that often run into several million impressions. The new rotogravure plant of the Alco-Gravure Division of the Publication Corporation, in Hoboken, N. J., provides a modern example of engineering the electrical system to simplify supervision and cost-keeping.

The scope of Alco-Gravure's production includes the printing of rotogravure newspaper supplements, magazine sections of Sunday papers, regular magazines, commercial rotogravure printing of catalogs and other forms of advertising material. One Sunday magazine

supplement, printed for some 24 newspapers, requires well over 5,500,000 copies weekly. A semi-monthly pictorial magazine of over 2,000,000 circulation is also printed. Advertising matter runs up to 14,000,000 impressions for some orders.

This plant is said to be the largest and most modern of its kind. Engineering details were in charge of the Ballinger Company of Philadelphia, who worked in cooperation with Alco-Gravure engineers and the electrical staff of A. Neri, Inc., industrial electrical contractors of Hoboken. The electrical work totaled some \$250,000.

Housed in 130,000 square feet of plant covering almost two city blocks are the complete facilities to produce

many millions of rotogravure impressions per month. But these printing operations are dependent upon many diverse operations by the 250 skilled workers in this plant. The engraved copper-plated cylinders used in the high speed presses are the product of art work and layout, photographing, plating, grinding, etching and other departments. All of these must function in close coordination and on the basis of specific cost schedules.

Since this new Hoboken plant is the newest of the five Alco-Gravure units, it embodies sound experience gained in gearing up high-speed rotogravure production facilities. All operations have long since been reduced to accurate cost values. So it is significant that electri-



PLATING ROOM where one-ton press cylinders receive their copper film upon which etchings are made for the final printing operation.



CENTRALIZED POWER shortened heavy bus runs. The switchboard room adjoins, and is near the heaviest loads.

cal instruments were so liberally provided, as a means of checking various steps in production in this latest plant, with its many improvements in mechanical design.

Use of Instruments

Here are some of the functions of instruments installed in the Alco-Gravure plant:

1. Every department is metered to record its consumption of electrical energy.
2. Power factor for the entire plant is indicated.
3. Total ampere load on any phase of the main feeders may be checked.
4. Voltage is indicated between phases, or from phase to ground at the main feeders.
5. Voltage is constantly recorded for important departments, such as the photography room.
6. Control panels for high-speed presses have ammeters for checking motor current as an indication of mechanical trouble in presses.

7. Temperature alarm gives warning if transformers become excessively loaded.
8. Individual graphic instruments in the plant manager's office provide a 24-hour record of all presses. These indicate when they start the runs, how long it takes to get them to full speed, their rate of production, when they stop and for how long.

In addition to these applications there are numerous other instruments on panels and switchboards, as in the plating department, for motor-generators, and at the shop test board.

To record the kilowatt consumption in important departments required a feeder layout suitably designed for separately metering various production areas. This was done by placing watt-hour meters in the main switchboard room and installing separate feeders from that point to the load distribution centers. The present metering arrangement comprises eleven meters for

power, four for power and lighting combined, and seven meters for lighting only.

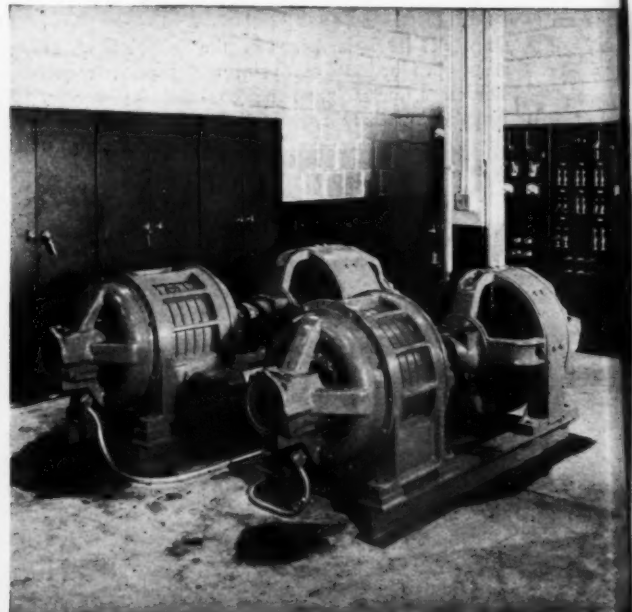
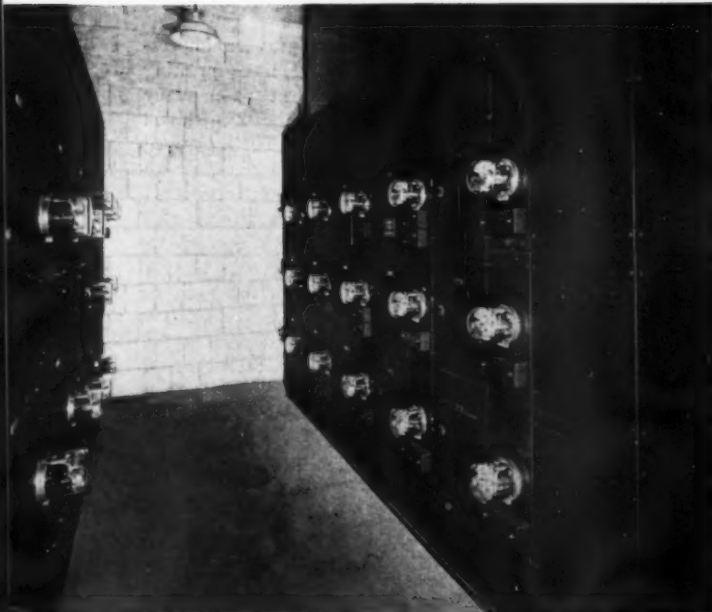
The steel-clad dead front main switchboard is in two sections placed in parallel rows. All heavy power feeders are controlled by air circuit breakers, and the smaller feeders employ fused switches. Meters are of the socket type located on steel panels beside their corresponding feeder control devices. A neat steel panel in the switchboard room accommodates three indicating meters, connected to the main feeder buses. They are a power factor meter, wattmeter and ammeter, each with a phase transfer switch.

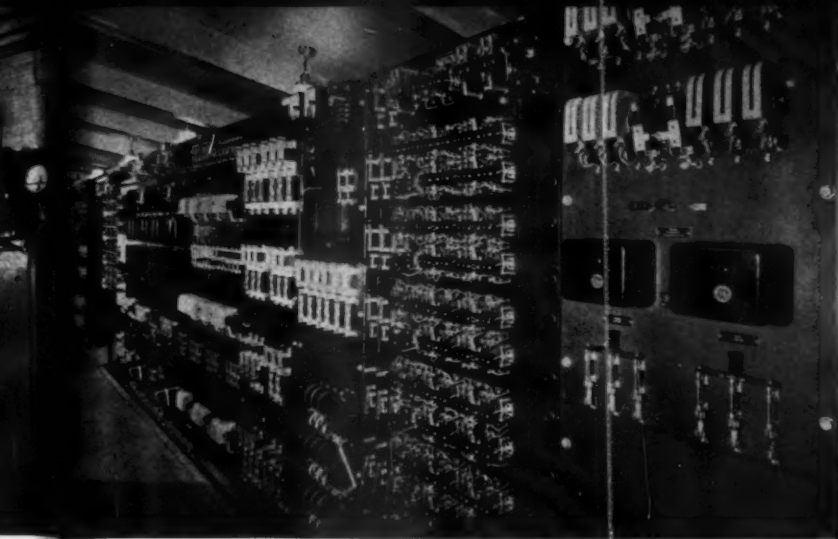
Transformer Location

Heavy service capacity was required to serve over 300 motors totalling nearly 2000 horsepower, the plant's varied lighting needs, the miscellaneous

OPERATING COSTS include current consumed by all departments. The main board has watt-hour meters for each feeder connection.

CORRECTIVE LOADS of two 50-hp. synchronous motor generators keep power factor in the middle nineties.





NERVE CENTER for press control are two switchboards, facing the pressroom behind glassed enclosure on a double-deck gallery.



PRESS SCHEDULES are geared high, and these graphic tachometers tell the complete story in the plant manager's office.

electrically heated equipment. It was done most economically by placing the plant's transformer station at a central point surrounded by the heaviest power-consuming departments. For instance, the two-story layout of press control switchboards is located in an adjoining room.

There are three active transformers and one spare, all rated 333 kva. The use of transformers containing non-burnable liquid made it feasible to locate these large units in heavy load areas. The 4150 volt, 3-phase primary service is underground, consisting of an active feeder and a spare or emergency feeder of equal size. These feeders were terminated on separate poles for connection to the power company transmission line. This is a further precaution against a possible feeder failure being likely to damage the spare feeder.

Many special problems were encountered in this job. They required detailed study and design to provide the refinements sought. Here are a few examples—

1. Large studio cameras in the photographic gallery require absolute freedom from vibration and voltage fluctuation. With four-color shots being made at exposures timed from 30 seconds to 40 minutes in duration, this type of photography is extremely critical.

2. Harmful voltage fluctuations likely to result from excessive motor starting inrush were avoided by the careful application of motors. For instance, all squirrel-cage motors over 10 hp. in size are multi-wound, and employ 3-step starters. Motors from 5 to 10 hp. are also multi-wound, and have 2-step starters. Three 40-hp. motors, which drive refrigeration compressor motors for the plant's air conditioning system, have sequence relays in conjunction with their 3-step automatic starters. When one motor starts, another 40-hp. unit cannot be thrown on the line until the first one has attained its normal speed.

3. To check vibration, the three motors and compressor units for the 120-ton refrigeration plant were placed on a reinforced concrete platform which floats on ten rubber pillows or air jacks. These jacks are inflated to 28 pounds air pressure, to keep the floating platform $\frac{1}{8}$ inches off the concrete floor.

4. The wiring for the pressrooms involved a maze of details. The high speed 12-unit perfecting presses, each require about 46 motors to operate all the intricate sections. There are motors for main drives, threading, roll pressure, pasters, ink pumps, angle bar, drying, and paper conveying. Controls for all presses are arranged in a two-level switchboard gallery, which is enclosed in glass, in full view of the press room.

To bring all control conductors to the control board from the many button stations and auxiliary control devices employed on the press units required the use of 30-conductor color-coded cables. Under-floor conduits for the press wiring were brought to full length floor junction boxes upon which the switchboard panels were set.

5. The monster 12-unit presses are approximately 118 feet long and have 18 magnetic brakes which stop the entire press within 8 to 12 feet of travel, when paper is going through at the rate of 950 to 1500 feet per minute. Photo-electric cells are used to detect paper breaks, and to automatically energize the emergency brakes. Special applications of electronic tubes are also extensively incorporated in various phases of the press control, as for the roll pressure motors and other extremely complicated operations.

6. In mixing inks for color presses, a photo-electric cell controls the weighing and pumping of flammable ingredients. A scale beam that is actuated by the loading of the mixing tank is equipped with an "electric eye" on the scale dial. When the scale pointer intercepts the light beam, a photo-electric relay operates solenoid valves and also controls the pump motors.

7. Signal and communication facilities include an inter-communicating public telephone system, a 24-station interplant private telephone system, code calls, time



MOTOR TELL-TALE panel in Chief Engineer Degan's office has pilot lights to indicate which air conditioning and fan motors are running.

stamps and recorders, a clock system, sprinkler alarms, press alarms, lamp signals on presses and other machine groups, transformer alarm and voltage drop alarm. For instance, the entire system of air conditioning and ventilating fans is registered on a master pilot board in the chief engineer's office showing when all sections are in operation.

Here then, are just a few examples of planning electric service for modern gravure printing to aid in simplifying this complicated production process. The very essence of it all is control. And this control centers in electric instruments which watch, indicate and record the major operations and measure the results in terms of production.

Sound Intercommunication A Contractor's Job

A typical installation in Madison sold and done by O. M. Bradford. How it works and why it pays.

By W. T. Stuart

JUST because sound intercommunication, loud speaker paging systems and the like involve a few vacuum tubes, some folk say they are beyond the ken of the electrical contractor. They think this work ought to be handled by sound engineers.

But electrical contractor O. M. Bradford, who runs a thriving business in Wisconsin's capital city of Madison, doesn't agree. In fact, he sells sound intercommunication systems and likes it. Typical of the contractor's opportunity in this kind of work is a Webster Electric Teletalk system he is now installing in the new nurses home for the Madison General Hospital.

The original idea was to put in a return call buzzer system, in each room, with a button board at the reception desk and phone communication to each floor. But Bradford got busy, together with Frank Reynolds, star Graybar salesman in the Madison area and took the story of sound intercommunication to the hospital board and the architects. They did a selling job. They sold a 96 station system.

In operation, the girl at the reception desk touches the line switch and says, "Miss Jones, you have a caller." Miss Jones replies through her room loud-speaker, from anywhere in the room, "I'll be right down," or perhaps she says, "Listen! Tell him to keep his shirt on till I get out of the bathtub." If a retort like the latter is expected, there is a convenient receiver on the master station which restricts the reply to the reception clerk's ear.

If Miss Jones wishes to call the reception desk she pushes a button on the speaker. The reception clerk replies by operating the line switch.

But Bradford Electric Co. gets more

THE BENEFITS to the hospital are many. In a word it is complete inter-communication from office to rooms with a minimum of effort.

SYSTEM INSTALLATION requires a substantial wiring job. The conduit lines above rise from the cross-connecting cabinets in the basement to carry the sound circuits. The junction box will provide a terminal for the flexible cord to the master station.



MADISON CONTRACTOR O. M. Bradford likes sound system work, avoids grief by handling only high quality equipment

out of it than just the sale of the sound equipment. There is also a sizable wiring job involved that means added profits. For example, in wiring materials alone, here is what goes into this 96 station job—

- 96 4 in. square boxes with covers
- 1 main cross-connection cabinet
- 10 branch cross-connection cabinets
- 1,000 feet $\frac{1}{2}$ in. electrical metallic tubing
- 600 feet $\frac{3}{4}$ in. electrical metallic tubing
- 1,100 feet 1 in. electrical metallic tubing
- 220 $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. box connectors
- 11,000 feet twisted triplex phone wire
- 2,500 feet No. 18 $\frac{1}{4}$ SBRC stranded

And, to these materials add several hundred dollars worth of installation labor—a sizable job in any town.

Wiring connections are no more complicated than any other type of intercommunication systems. Each station has an individual twisted triplex connection to the master station and a No. 18 common return on the push-button circuit. The master station derives its power supply directly from a 120 volt a.c. receptacle circuit.

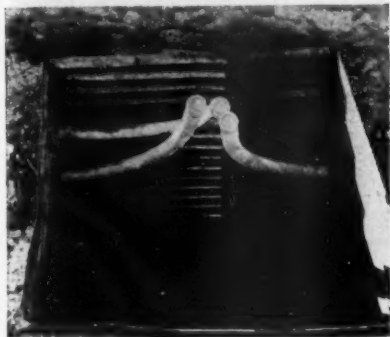
But what about service and similar grief? Aren't special service facilities necessary? Bradford smiles at these questions. He points out that contractors install transformers without worrying about hysteresis losses.

High quality sound systems, produced by reputable manufacturers and distributed through the regular trade channels are just as stable and trouble free as any other quality electrical apparatus, he says. He lets the manufacturers engineers work out the details of internal stability and ruggedness. He sells and installs the system.

Electrical Contracting, August 1939



BASE FORM—Made of light-weight, ungalvanized sheet iron, corrugated and bent into shape, spot welded at the seam, these forms make the concrete base for a lighting standard. They are inexpensive and save time.



TRUCK TRUCK, with extended rigging, pulling the cable between one street lighting standard and another. Lloyd Flatland, at left, is supervising. Note position of winches, drums and controls, also of stiffening supports.

LLOYD FLATLAND of Globe Electric Works, San Francisco, believes in a high standard for labor and likes to keep a small, well trained crew steadily employed. If possible he so plans their work that it is not necessary to rush in a number of new men to complete a job. Rather he spreads the work among the crew so that they can do bigger jobs in the required time and keep more steadily employed.

To aid them to do this, he has shown them the advantage of using the ingenious labor saving tools which he provides. With these tools they are enabled to maintain schedules and to spread themselves over the broad field of construction and maintenance service which this company handles. A swell example of how this works, is a street lighting installation on 19th Avenue, San Francisco. It was a street widening project in which this arterial street was doubled in width, and street lighting run down center dividing parkway.

A plow designed by Martin Flatland, father of Lloyd Flatland, a pioneer electrical contractor now head of the firm, was brought out from the ample tool room of Globe Electric to serve this new purpose. With this plow, designed for a San Diego job many years ago, a narrow trench was cut for the laying of the 3-in. conduit. Pipe was assembled above ground and dropped into the trench. Thus 2,800 ft. of 3-in. conduit including elbows, fittings and bends was laid in three days by one man and a helper.

For anchor blocks at the base of each standard, another ingenious idea was used. Flatland obtained large sheets of thin sheet iron. These he had corrugated to give them stiffness. A means

was found to bend them into square boxes, spot welded at the seam. Fashioned in the shop, they were carted to the site and placed in an excavation at the base of each standard. The thin metal sides were easily punched to run the conduit through. Concrete was then poured from a transit truck, bolts set for anchors to the base of the standard, and the form left on the block, its corrugated sides an added value to the stability of the anchor block.

Globe owns a Sterling truck that is certainly a jack-of-all-trades. Mounted on it is an air compressor. Between this and the cab, Flatland has erected a framework supporting an adjustable and retractable rigging useful for several purposes. Gear trains are provided for power winches too in several combinations.

Here's what the truck does.

1. The air compressor does a clever thing. With a swab as a head, a plunger is blown through the underground conduit pulling after it a fish tape. Thus, the conduit is swabbed out and the pulling tape is inserted in one operation.

2. The truck with its winches is used to erect the street lighting standard and true it up. Finally the same truck comes back to pull the cable, and to set the tops and lamps.

3. On the side of the truck body is mounted a large wooden cable spool connected to the winch shaft. This is used as a take-up reel for winding the cable itself. On its outside rim is a removable spool made of a truck rim on which the pulling wire or tape is wound up ready to be used the next time. For sheaves, Flatland uses automobile rims and wheels mounted on an angle iron frame which can slide out the required length from the truck and be retracted when traveling. Two removable pipe supports are used to stiffen the end of the frame when pulling cable. The auto wheels are light, strong and equipped with roller bearings, which all contribute to the efficiency of the rig.

In cable pulling, where two or more standards are grouped, the lead cable is payed out for a continuous loop, pulled between the first two standards, the surplus being wound on the big spool. Then the spool is removed, another put in its place, and a second loop pulled to the next standard, and so on. This saves time over individual cable pulled for each run.

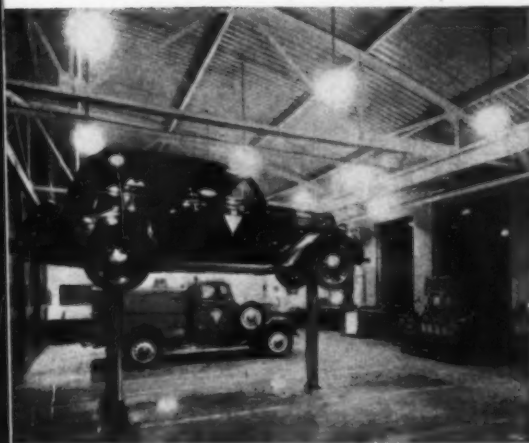
With general and street contractors breaking into the installation of street lighting, Flatland feels that it is up to the electrical contractor to use his brains and experience to devise machines and equipment that will enable him to keep this business for electrical contractors.

Machines that Steady Employment

By W. A. Cyr

COMMUNITY BUILD-UP—Good lighting employed in Ohio Edison's new service building provides practical examples for demonstration to local prospects.

AUTO SERVICE shops have raised lighting levels after seeing the effects of 30 f.c. with 300-watt Holophane units, and 200-watt Crouse-Hinds floor units under lifts.



This Wiring

METER TESTING provides an example of important factory seeing tasks. Here 40 f.c. is provided with 500-watt Wakefield Commodore units.

EVERYBODY has become more light-conscious, and therefore more interested in seeing examples of good lighting. So when the Ohio Edison Company built a new service building for its Youngstown Division, the lighting was designed for a dual purpose. First, it was designed to provide each area with illumination best suited to the type of work involved, and second, to set a practical lighting example for the community. It was anticipated that local lighting salesmen would have frequent occasion to use the premises as a showroom.

Here is a building in which the visual requirements are diversified. These include the fine-seeing tasks of draughtsmen and office routine, service shops for metering instruments, a repair shop for automobiles and trucks, a complete



machine shop. Also there are large storage areas for materials, parts and trucks.

And since this new building has been occupied, direct results can be credited to demonstrating its lighting system. Several local automobile service shops

have raised their levels of lighting spurred by looking at this company's shop. A number of downtown office lighting installations have been modernized after visits were made to the office spaces in this building. The standards for public buildings in the



EYE COMFORT is provided here with 30 f.c. 500-watt magnalux units. Office visitors have already followed suit in their own premises.

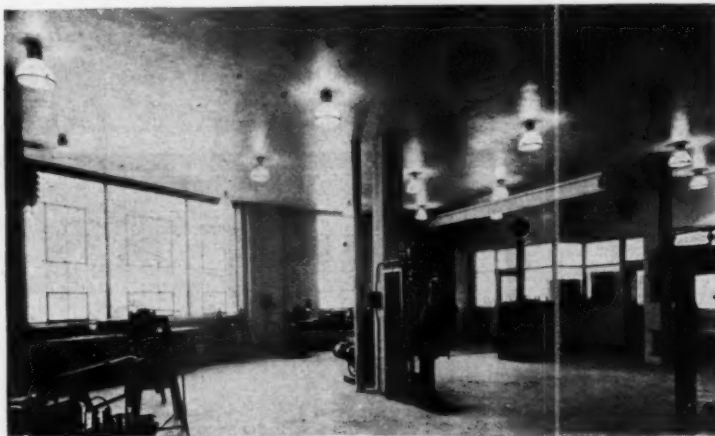
STORAGE SPACES for cars and trucks average 7 f.c., using 300-watt widespread Holophane reflectors.



MACHINE SHOP conditions, in the sub-station department, provide 16 f.c. with 300-watt Holophane widespread reflectors.

Sells Light

New Ohio Service Building sets practical example to build up Youngstown's lighting prospects



county have recently been raised appreciably because of inspections that were made at the service building.

The wiring and lighting equipment was installed by the Carlson Electric Company of Youngstown. The installation differs in some respects from

conventional layouts. The structure includes two floors and a partial basement, 268 ft. long and 140 ft. wide. Small circuit breaker panels were placed in various areas on the three floor levels to serve as switching centers, as well as circuit protective de-

vices. This required 32 lighting panels, all of which were 10 circuit size or less. Usually a lesser number of larger panels would have been used and the greater areas served by them would have required the use of larger circuits. With this layout however, the circuits were held to relatively short runs of No. 10 wire. Circuits less than 50 ft. long employed No. 12 wire. This circuiting scheme eliminated branch circuit voltage losses to a great extent.

Separate feeders were installed to all lighting power panels and each feeder has individual circuit breaker control and protection on the main switchboard. All lighting panel feeder conduits were standardized at 1½-in. size, which simplified the installation routine.

Getting into the SMALL MOTOR BUSINESS

THE increased volume of small motor repairs required for refrigerators, stokers, blowers and other apparatus has placed motor service shops in a position where this class of work must be handled quickly and at a very low cost. Under past shop methods it has been practically impossible to satisfy many customers as to the time involved or to derive a reasonable profit from the price charged.

The Tennessee Electric Motor Service shop does only small motor work, handling nothing larger than 3 hp. It has been operated with a fair amount of success on this basis for three years. Out of this experience, these facts stand out—

1. Reasonable profit in this business requires a volume of at least 20 motors per day.
2. A five man shop can be operated at maximum efficiency on this volume.
3. This volume costs approximately \$100 in material and \$139 in labor.
4. Work will come from relatively new customers such as appliance dealers and ice cream manufacturing companies, rather than from industrial plants.
5. Flat rate price schedules must cover in detail the most popular type motors.
6. Prices must be competitive with other shops specializing in small motor work in your community.
7. Set up a separate department, the size depending on your anticipated volume.
8. Provide special equipment such as speedy coil winders, dynamometer test stand, Yankee screw drivers and other high speed tools.
9. Mechanics must be a different type, preferably young and inexperienced, men who can be trained in production methods, to do one particular part of the work well. The simpler jobs form about 90 per cent of the small motor volume.
10. Abandon the old method of going to the stock room for material for each job.
11. We handle only the popular and conventional types of motors on the flat rate prices. Specials and non-conventional jobs are handled in the old way and charged for on a profitable basis.

Also, we build up an exchange stock of rebuilt motors of all popular types. This will result from selling new motors and taking in the old frames at a small allowance. We also build up a large stock of the popular type armatures and

stators. In dull times keep winders busy getting these stock units ready. When we are rushed with incoming jobs the assembly man can use this surplus stock and tide over a rush period without extra help. This so called core stock is absolutely essential. We maintain a core stock of approximately 100 armatures and 100 stators.

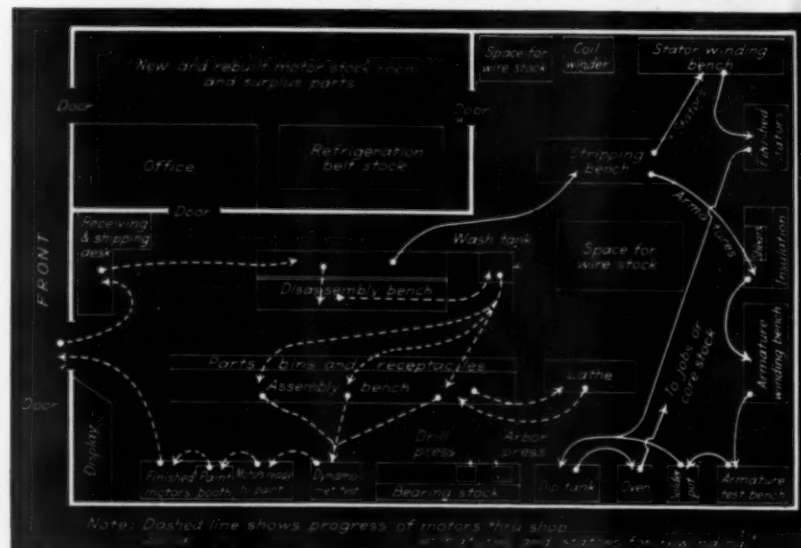
A stock of rebuilt exchange motors helps maintain an even flow of work. For instance we will say our capacity is 30 per day and that on a certain day we receive only 20 jobs. On that day we get out the 20 jobs and 10 stock jobs. The following day we receive 40 jobs, repair 30 and exchange 10, which makes everything go out on time. This prevents being over-rushed the second day, which would possibly result in poor workmanship, unnecessary overtime, or delayed jobs. On the first day, when only 20 came in, the men would have a tendency to loaf on the job, which cannot happen in a successful small motor shop. For wasted time is money lost.

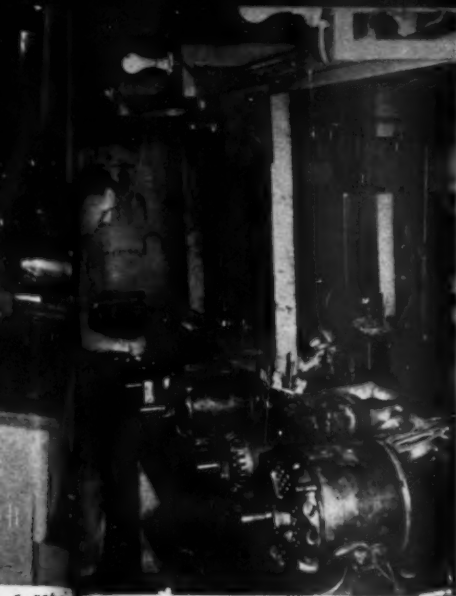


AUTHOR H. E. GRANT makes out a repair order on a fractional horsepower rewind job.

You must save steps, pennies and seconds in this business. For instance, we have above and under each bench where parts are needed, dozens of bins for all parts used on that bench. On the bench where the arbor press is located are bins containing bearing, commutator and governor weight stock. Everything that has to be pressed in or on, is in reach of the arbor press operator. Brushes, brush holder, short circuiting devices and the dozens of other small parts are located in bins and receptacles about that end of the bench where repulsion induction motors are assembled. Similar parts and material bins are provided at benches for the assembly of capacitor motors, where the finishing touches are made to motors, and at the bench utilized for

STEP-SAVING LAYOUT for small motor repairs in a 25 by 60 ft. space. Work moves in sequence to the next operation for maximum production efficiency.





a repair
wind job.

TESTING AND dis-assembly, 12 motors at a
time are handled with speed tools.

insulating. Incidentally, we buy from the factory, ready cut and shaped, the major part of our slot insulation and wedges.

We keep no individual records of material used in each job. On a monthly basis our total material cost will not vary more than a few percentage points one way or the other. After all we are repairing motors by the dozen rather than one at a time.

Flow of Operations

When motors arrive for repairs a repair card is made, and a tag bearing the customer's name is attached to each motor. Motors are placed on the disassembly bench in lots of 12. They are disassembled with speed tools, the various parts—except armature and stator—are placed in a pan opposite each motor, the man going down the line and working the 12 motors as a group. Next each armature and stator is tested and examined for visual defects by means of a test set that glides on a track the entire length of the bench.

Defective units are laid aside and good units placed with balance of parts. After the group is finished, the man washes and cleans the parts of each motor with compressed air and places the pans on the assembly bench. Other operations include soldering, balancing, installing new leads, bearings and parts such as brushes and brush holders. Then the motor is completely assembled except for oil wick covers. The motors are then tested on the dynamometer test stand and final adjustments made. Finishing touches such as installing oil wicks, covers and painting are done by a less experienced man.

Defective armatures and stators are wound, wherever possible in groups of

Details of an interesting experience as told to the motor shop men at the recent NISA convention in St. Louis

By H. E. Grant

Tennessee Electric Motor Service, Nashville, Tenn.

the same make and types. On the popular type jobs, we make several sets of coils at a time and store the extra sets up for future use. Armatures are wound by hand and new commutators are installed on about 90 per cent of the jobs. We solder all vertical commutator jobs by rolling the edge in molten solder, and horizontal jobs by dipping in molten solder.

Dipping is done at one time near the end of each day, all baking at night. Except on specials each job is baked. Our special tools include Carboly tipped turning and boring tools, plates for pulling off parts without damage, arbors for pressing on commutators and governor weights the correct distance, and arbors with which to press out old bearings and press on new ones at one operation.

Our method of paying productive help is different from that used in the large shops. We believe it is the only satisfactory way of paying for small motor work.

Productive men are paid 40 per cent of the net labor, figured on a monthly basis. By net labor we mean the gross amount received for repair work less the amount paid for material. Each man receives, according to his value, a certain base pay on a bi-monthly basis. At the end of each month, when the

amount of net labor is computed, we take 40 per cent. From this figure each man's base pay is deducted. The amount that remains is divided among the men in the same ratio as their base pay and given to them as a bonus.

Self Interest

This system has the advantage that the more work is done the more each man makes. Also if any work comes back they do not receive the benefit from it, which leads to more careful workmanship. Also as the parts used affect the size of the net labor figure, the men will not use unnecessary parts nor will they skimp on parts for fear of a comeback job. It is the best interest creator that I believe possible. We only work overtime in extreme emergencies. Then the men are paid in excess of regular rates and the jobs are handled at special prices.

In conclusion, if there is a small motor shop in or near your city that is doing a good job I do not believe that it would be advisable to set up competition unless you are sure there is enough business to go around. However, if there is no such shop and you are not now making money on your small motor work, by all means set up a small motor department and go after sufficient volume to make it pay.

CLOSE-UP of small
part stocks at assem-
bly bench. Glass
jars are suspended
from screw caps
fastened to the
under-side of shelv-
ing. Jars, hanger
rods, tin pans, and
bins bring the ma-
terial within reach.





COOL LIGHT replaced incandescent lamps in this full fashioned hosiery knitting mill. Fluorescent daylight lamps provide 50 foot candles without worker discomfort.

FINE THREADS require close observation. Spacings provide high levels of illumination without reflected glare from polished surfaces of knitting machines.



A southern plant doubles its light with a third the former wattage in an extensive re-lighting operation.

Fluorescents in a Hosiery Mill

THE windowless and air conditioned plant of the Hudson Silk Knitting Company at Charlotte, N. C., recently changed over from industrial type incandescent units to fluorescent lighting. Using 30-watt, 36-inch daylight lamps, operated at 220 volts, the new installation offers these advantages—

1. High intensity of soft localized illumination, averaging 50 foot-candles, free from shadows or glare.
2. No supplementary ceiling fixtures needed.
3. Reflections from polished surfaces of knitting machines reduced to a minimum.

4. The cool light source permits mounting fixtures close enough for high-level illumination without discomfort to operators.

5. Day-light illumination has a pleasing psychological effect on the workers.

6. Existing circuits provide abundant copper because of utilizing 220-volt lamps.

This installation embraced 400 single concentrating trough reflectors. These were Miller-Ivanhoe No. FTC-36 individual units, which accommodate 36-inch fluorescent lamps.

To light the full-fashioned hosiery knitting machines in this plant required careful positioning of the units. Be-

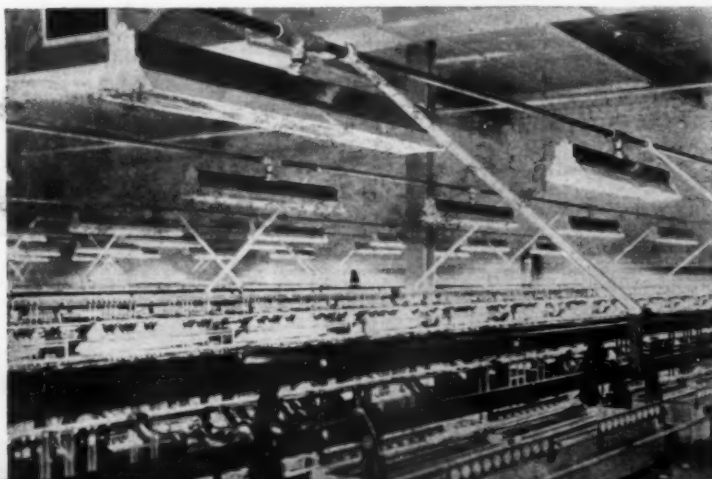
cause of the minuteness of silk threads and fineness of detail, the knitters need good illumination by which to observe the operation of machines and to make repairs or adjustments quickly and easily.

The 26-section knitting machines are lighted by units mounted 42 inches above the needle bars, and are spaced 6 feet on centers, or 33 inches apart from end to end. With this spacing there is adequate light on the most critical seeing areas, yet also sufficient spilled light beyond the ends of the fixtures.

The photographs show how these individual units were mounted and suggest their advantages in meeting existing conditions. They may be located lengthwise or crosswise on ceilings, between beams or overhead equipment, at whatever height or position a particular work area requires. Angular adjustments can be made individually by using brackets, and these units can be readily re-located if changes are made in the machinery layout.

INTENSITY DOUBLED with lowered wattage justified the re-lighting cost. The use of 220-volt lamps also relieves the circuits of possible overloads.

Electrical Contracting, August 1939



"For we are on the Up
and Up,
As built by Cutler-Hammer.
On us you'll find no place
to squat.
We work in proper manner."



VERTICAL CONTACTS mean better motor control. Dust between contacts causes heating and burning. But dust can't settle on VERTICAL contacts. So Cutler-Hammer VERTICAL CONTACTS need not be buried. They're out in the open . . . always air-cooled, easily inspected, fully accessible—yet free from dust and dirt. Get the facts. Send for free book, "Dust, the destroyer." CUTLER-HAMMER, Inc., Pioneer Electrical Manufacturers, 1306 Paul Ave., Milwaukee, Wisconsin.

**ONLY VERTICAL CONTACTS
CAN BE DUST-SAFE!**



Editorials

Earl Whitehorne, Editor

The Council Resumes

News that the Council for Industrial Relations is to resume its activities will be welcomed by the entire electrical construction industry. The Council has a proud record. Over a period of twelve years, in which it arbitrated disputes between electrical contractors and the union workers, there was a complete freedom from strikes. Warfare between management and labor ceased in the industry, because there was a wise court to go to when employers and employees could not agree. Its good work stopped only for lack of a sponsor that could represent the electrical contracting industry.

Now that NECA has re-established its labor section, its Labor Relations Committee, and 300 new members have joined the association to take advantage of it, the re-sponsoring of the Council is more than logical. It supplies a service that our industry has been needing badly.

NECA and IBEW men can now sit down together once more and find the sensible solution to labor problems as they arise. And it is particularly fortunate that L. K. Comstock is to again be chairman of the Council. His leadership and judgment in these matters has been proven sound and courageous.

Engineers For Contractors

Fitting the graduate engineer into the electrical contracting business has been a trying process to employee and employer alike. The trouble is that the average graduate engineer needs as much specialized training after he gets into the contractor's office as any other intelligent young man. The engineering training is splendid background, but not immediately usable.

Too often, the most promising men soon abandon the contracting industry for jobs with utilities or manufacturers where they can cash in on their expensive education more quickly.

But at Purdue University, instructor R. B. Marshall of the School of Engineering has set up a course to prepare engineers for the electrical contracting industry. The course includes such practical training as the study of wiring materials, design, layout, specifications and estimating to prepare men to handle responsible jobs with a minimum of additional training. This project is worth watching.

Beating Attic Fan Competition

This year will probably show a new peak in attic fan sales for the country. Electrical contractors are getting a lot of this business but other industrial groups, scenting profits, are trying to muscle in. Building equipment dealers, hardware dealers, heating and ventilating houses all want a crack at it.

The electrical contractor has an ace in the hole. That is—control. The satisfaction the home owner will get out of his attic ventilating fan depends upon how easy it is to handle. The attic fan installation needs convenient switching, preferably on both first and second floors plus time switch control to provide either fully automatic operation or a cut-off after a pre-determined time lapse. In this competitive market we have an edge. Let's make use of it.

So the Idea Goes Over

They say the postage stamp is highly thought of because it always

sticks to one thing until it gets there. It's the same with any good idea—like Red Seal, for instance. Toronto keeps on, year after year until now most of the new houses are wired to that standard, with over 25,000 in the city.

In the West Penn Power territory, they certified 444 houses in 1937 and 696 in 1938. Most of the contractors are plugging for it. W. H. Marshall in State College, Pa., did 43 jobs last year. And because they all stick at it, the idea is getting over.

Access to Wiring

One of the great advantages of electric power is the ease with which it may be measured. This is not only an advantage from the standpoint of maintenance and trouble shooting. Instrument indications, graphic records and accumulated kilowatt consumption for a known period of time can be used to tell something about the process or machine driven by the motor. Unfortunately, however, few power installations are originally designed to make instrument testing convenient.

Here is something to keep in mind for your next industrial power job. Provide a test block or other means of easy access to the motor circuit, where instruments can be applied. And test facilities should be so arranged that they will not interfere with the motor protection.

Progressive management is looking for new methods of checking production. It will be quick to recognize the value of such an installation.

Radio Interference From Bare Neutral

Discussion of bare neutral wiring systems in the electrical industry centers principally around safety and engineering factors. Now, a protest comes from another angle—radio interference. The Institute of Radio Engineers and the Radio Manufacturers Association have asked the NFPA Electrical Committee to reject the proposals for bare neutral wiring systems and covered neutral cables.

Their reason—static. A bare neutral conductor in a metallic raceway may have an insignificant voltage between conductor and conduit under normal conditions. But the difference is enough to cause plenty of static in existing radios.

With television coming along, using

Electrical Contracting, August 1939

high frequency channels acutely sensitive to man-made static, radio men have been working feverishly to eliminate or filter static producing appliances. To them, the random contacts of bare neutral systems offer an appalling engineering problem, out of all proportion to the advantages of such a system.

Frying Pan to Fire

"In attempting to solve a problem we sometimes create other problems more difficult of solution," says the Division of Electrical Inspection of Chicago. Because that is a wise saying, it sets the type up in Old English script.

We see plenty of it. Local associations work out intricate schemes to solve the bidding problem and fall right into a squad of Mr. Ickes' investigators. Again we work up a respectable lather trying to find a better way to sell wiring by inventing new wiring systems. And up come a flock of both technical and human problems even more troublesome.

It is time to hit on the idea of simplifying things instead of making them more complicated. But maybe it is more fun thinking up a new scheme, than going to work to make an old method bring results.

Use These Little Giants

The operating of electrical machinery through the aid of the electron, has already become an important feature of industrial control.

Fortunately, we do not have to understand the electron to use it. It lies in the realm of scientific mystery—the tiniest division of matter known to man. But manufacturers have perfected electronic control devices, able to perform incredible operations. They come in simple packaged form requiring only a few connections and adjustments to put them in operation.

Photo cell controls do a far better job of seeing than the human eye. Mechanical memories can look over the situation and do something about it in seconds or even minutes later. Electronic ears can distinguish tones far more accurately than the ablest musician. These are everyday services of eminently practical value in industry and commerce. And no one is in a better position today to extend the field of application than the electrical contractor.

It Builds the Job

Many architects want to keep the electrical contractor away from their clients. They don't want him messing into the plans and unselling the owner on this and that. But some contractors work so closely with the architect that they always have a conference with the owner for reviewing details.

It pays because the contractor can point out opportunities for more adequacy, more convenience that the owner is eager for, once he understands. It builds up the job. It also increases the owner satisfaction.

Back Talk

Save the Design, Too

To the Editor—"I think your editorial 'Save The Job' is thoroughly good and just the kind of thing we need. It occurs to me, however, that there might be some fear of misunderstanding in your use of the word 'estimating'. You appear to lump in that one term design, specification and estimate.

"As I see it, what your editorial is directed against is incompetent design and specification. The actual bid on a certain definite specification doesn't cut so much figure. What the customer wants and needs is a competent and efficient design and it is in the specification that he is really most concerned. This is not meant as a criticism but a suggestion."

H. A. Wagner, President
Consolidated Gas Electric Light
& Power Company of Baltimore

Perhaps the trouble comes more in the design and specification, but it is all so commonly covered by the term "estimating" that we think it will be understood as such. Then, of course, the matter does go further than the installation design and specification. It calls for sufficient courage to adequately cover overhead and profit. For without all this, competition is on the wrong basis and the strife to lower prices sets in. But you are right, Mr. Wagner, in that adequacy in wiring can be destroyed in the design and specification even before the pinching of price appears upon the stage.

More About the Code

A few weeks ago, we sent a letter to electrical contractors throughout the country, asking for a direct expression of their attitude toward the proposed changes in the Code. The results of this vote by more than a thousand contractors will be published in our September issue.

Meanwhile, many letters have come in commenting on this matter of Code revision. Here are a few that are of interest.

To the Editor—"I am astounded at the forces that are at work to tear down the constructive effort of the men, who have fought for 30 years to develop safe and sound methods. With this trend it is only a matter of a few years until your electrical installations will be made by untrained, unskilled and irresponsible men—any type of mechanic on the job. Quality and protection against life and property will be lost for ever."

C. H. Veale
Veale Electric Company, Tulsa, Okla.

To the Editor—"I am opposed to any un-insulated wires anywhere. Also, the colored wire has done much to ruin the electrical business. It has put the journeyman electricians out of work and give it

to the farmers and garage mechanics, because under the present system a 12 or 13 year old boy can do wiring.

"The Code is not strict enough as it is. Every job should be made as safe as possible. Jobs outside of the cities where there is no fire protection certainly should be made safe. We should have a state inspector, who should require a journeyman on each job. The power companies should not connect to any building without a certificate that the job has been done by a licensed electrician."

George Davis
George Davis Electrical Co., Inc.
Greenville, South Carolina

To the Editor—"It has been customary for some time to run telephone lines, signal wires and such on a non-metallic open wire basis. To use conductor assemblies for light and power work, which would tend to resemble those used on auxiliary systems will in my judgment, tend to stimulate sloppiness in electrical wiring.

Furthermore, the advantages of the "pull-in" and "pull-out" system entirely justify the probable higher costs of this method of installation. It seems to me more important that we should endeavor to discover the true economies in electrical layouts by virtue of a better working knowledge of the electrical requirements.

"There is no question but what electrical densities are increasing and I am very happy to see the growth of the area idea in code circles for the determination of probable electric loads. Having determined the electrical load requirements, and the probable demand factor, the next step is the design of wiring layout. The consulting engineer and electrical contractor would do well to cooperate in furthering methods of design that will bring about the greatest economy for the consumer, rather than to concentrate merely on a search for cheaper wiring materials."

Allan Coggeshall
Hatzel & Buchler, Inc., New York

To the Editor—"I sincerely hope all the changes go through. Surprised? Well, it's really very simple (the answer I mean). I believe that it will give us more work if these changes go through. That means that new materials all get a good trial. If they work, okay, we'll get at least 10 per cent more wiring and if they don't work we'll get a job taking them out again.

"I haven't heard of CNX, Romex or BX replacements that weren't taken as a matter of course, so why worry! Let the changes strike as they may."

E. M. Pat Jensen
Jensen Electric, Council Bluffs, Iowa

To the Editor—"We are small contractors in a small town and if anyone should be in favor of making existing rules easier we ought to favor the changes.

"We would like to see a rigid enforcement of the present Code with perhaps a change in the area method of computing the load. It is our opinion that the power companies must find something other than this excuse for lack of sales in electrical appliances, wiring."

Harvey S. Hatch, Treasurer
Davis & Morgan Electric Co., Inc.
Plymouth, Mass.

To the Editor—"I feel that a testing laboratory or Code authority is not obligated to approve or disapprove any change in the Code, taking into account only the whims or fancies of any group.

"If men that have final say feel deep down in their hearts that contemplated changes would be safe and sane, and would not hesitate to have their own children surrounded by these changes, then let them approve. Not otherwise.

"The rest of the industry has ways and means of checking the decisions of any authority. Let these checkers meditate somewhat on the humanitarian side of their findings, and act accordingly.

"My conclusion is that other methods are too costly and compel us to retrace our steps."

Bernard Hiller
B. Hiller Electric Co.
Bedford, Mich.

These and the many other opinions that have come in recently indicate the very wide interest and concern that exist today among electrical men on this matter of the impending decision on the proposed Code changes. The Code defines not only the contractors' profession but his responsibility and his opportunity also. He cannot take it too seriously. And he should speak his mind about it freely to the men who represent him on the Electrical Committee.

WIRING Methods

OUTDOOR METERS FOR APARTMENTS

The outdoor meter which has proved so convenient for residences presents a quite different problem when applied to multi-family apartment buildings. To check into this problem, the Chicago Electrical Contractors' Association retained Ray Ashley to make a study and recommendations for this type of installation.

Chicago apartment buildings are usually built in the form of a U or a series of connected U forms, in three stories. Individual metering is the rule with a main service switch and a feeder system in the basement of the building running to meter locations from which branch circuits are carried to groups of six apartments.

Banking of the meters at the point of service would introduce a branch circuit line drop problem in the runs to the far apartments. In many cases this would require branch circuits of number 4 wire and larger to provide for only 15 ampere loads.

The plan proposed uses a main service switch, and a distribution panel for the sub-services to the meter location. The sub-services run through the basement to ganged meter switches beneath the apartment served. Meter switches are

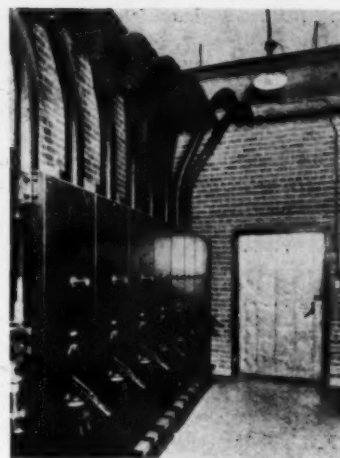
so located that conduit nipples can be extended through the outside wall to the outdoor meter mounting.

PLANNING FOR FUTURE LOADS

The Packard Motor Car Company plant in Detroit is a typical example of heavy electrical loads, subject to changes and the addition of more load. This view of the feeder distribution center adjoins the press room where huge motorized presses form body parts and fenders. Spare wall sleeves near the ceiling tell at a glance the story of provisions for adequacy.

There are two boards in this room, next to which is the outdoor transformer station accommodating three 500 kva power transformers and one 200 kva for lighting.

The 440-volt power feeder board (at left) comprises eight 600 amp. oil circuit breakers and steel panels. Each panel has an ammeter switch, current transformers and a meter test block at the base for connecting portable test meters. This board was so placed in the room to leave space at the left foreground to add three more panels. It is connected by means of $\frac{1}{4}$ by 6-in.



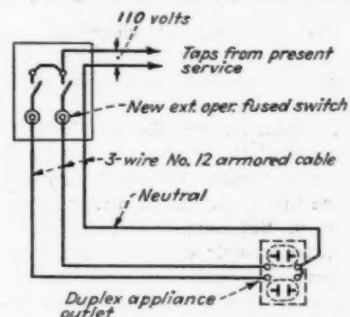
ADEQUATE LAYOUT—Packard feeder boards are so placed in rooms that it is easy to add on later.

horizontal supply busses.

The lighting feeder switchboard at the right missed the camera's range. It has ten 400 amp. Deion circuit breakers, and also has testing facilities similar to those provided for the power feeders.

DIVIDING APPLIANCE CIRCUIT LOAD

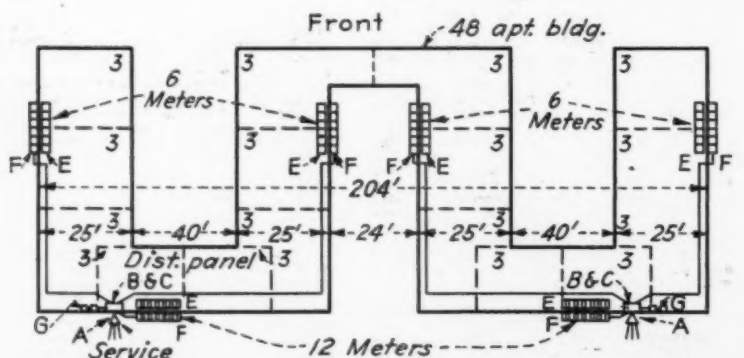
Rural and suburban customers in the Central Hudson area of New York are buying an appliance combination consisting of an electric roaster and



TWIN OUTLET for kitchen appliances wired on divided circuit protective devices.

twin hot plate. This is sold to lower income customers as a substitute for electric ranges.

In wiring for these appliances, Cavo and Donegan of Pleasant Valley, N. Y., install a new duplex convenience outlet in the kitchen, served by three-wire No. 12 armored cable. A tap is taken from the service switch to a new externally operated switch, to provide control and protection for this new circuit. Since most of these customers



APARTMENT METERING—Chicago contractors association recommends new plan for locating outdoor meters to reduce branch circuit runs in typical apartment houses.

"It's a BIG JOB to sell ADEQUATE WIRING in Old Homes —but the FUSTAT can help you do it"



Stops overloading that hinders the full use of electricity

The branch circuit is the "bottle-neck" of electric service, because through it flows all the "pay load" to the user. As this "bottle-neck" is overloaded, SATISFACTORY service diminishes because:

1. Overloading usually means a low-voltage condition that causes user dissatisfaction due to inefficient operation of lamps and appliances.

2. Overloading, when continued often destroys the wiring and causes money loss to the user — revenue loss to the Utility and tremendous loss of good will to the entire industry.

The Fustat steps in to help correct this overloading evil

Its non-tamperable feature shuts out "handy men" from substituting too large a size, and tampering it in any way to permit overloading is virtually out of the question — without such tampering being clearly visible where it warns the user that all protection is gone.

Since the user can't load a circuit beyond proper capacity of the copper, the Fustat eliminates revenue sapping low-voltage conditions —

And by blocking excessive overloading it prevents overheating that destroys wiring, creates fire hazards and causes costly shutdowns.

In addition, when a Fustat does blow to protect, only the normal load on one circuit is off the line — instead of a user possibly having a large part of his lights and appliances out of service.

User can't side-step adequate wiring issue

When additional circuits are needed the user cannot readily side-step the issue at the sacrifice of safety. New circuits that increase efficiency of appliances and encourage their greater use must be installed.

Wipes out any excuse for tampering

A Fustat won't blow when washing machines, refrigerators or other motors start because of its long time-lag. It wipes out any excuse for tampering or the use of fuses too large to properly protect when shorts occur in flexible cords.

Helps get more appliances on the line

The circuit can be loaded to approved capacity without needless blows — or sacrifice of safety — for the Fustat doesn't blow on starting currents.

Permits more outlets per circuit

Adding a maximum number of outlets is a perfectly safe practice because the Fustat guards the circuit against overloading.

It's just good business to sell, install and use Fustats

What is the Fustat?

It is a fuse to which a thermal cutout is added. It protects like a fuse against short circuits—even high resistance shorts such as occur in flexible cords. It protects against permanent overloads, even when as light as 25%.

Yet it will not blow on motor starting currents of washing machines or other appliances. It has a non-tamperable base that keeps anyone from robbing the circuit of protection. It fits Edison base fuseholders through the use of an inexpensive adapter.

Adapter retails at 7½¢



The FUSTAT

For full information write to any of these firms

BUSSMANN MFG. CO., University at Jefferson, St. Louis, Mo.
JEFFERSON ELEC. CO., Bellwood, Ill.
KIRKMAN ENGINEERING CORP., 121 Sixth Ave., New York City
NATIONAL ELECTRIC PRODUCTS CORP., Fulton Bldg., Pittsburgh, Pa.
UNION INSULATING CO., 27 Park Place, New York City



EVERY NEW HOME DESERVES-



THIS

THE "Magnetite"

Panel Board Circuit Breaker

Fully Magnetic, Non-Thermal

Every modern home owner merits the reassuring protection the new "MAGNETTE" Circuit Breaker offers in the form of insurance against electrical hazards . . . no more danger from "penny-plugging" or "fuse-cutting" . . . a flip of the switch and service is restored with safety, provided circuit load has returned to normal!

THE FEATURES:

- * Lasting service with no maintenance expense.
- * Simple re-closing . . . no resetting, no replacements.
- * Safety . . . breaker cannot be held closed against existing overload or short circuit.
- * Negligible wattage loss since nothing heats.
- * Cadmium-plated, corrosion-proof parts.
- * Boxes of code gauge steel, with baked-on aluminum finish.
- * Ample KO's and wiring space.

fool-proof PROTECTION



Illustrated: Cat. No. B01S, 3-circuit surface type panel. Complete line of panel board breakers available, in 2, 3, 4, 6, 8, 10 or 12-circuit combinations without door, and with door in combinations up to 40 circuits.



Write for Catalog 16

WALKER
ELECTRICAL COMPANY
ATLANTA, GEORGIA



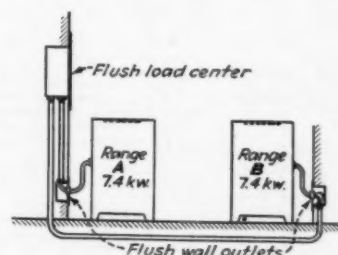
[FROM PAGE 22]

have 2-wire service, the new 3-wire circuit is connected as shown. Here the "hot" leg is divided at the new switch to place the twin convenience outlet on two fuses. The neutral serves both receptacles in common. Should the service later be made three-wire, this hookup can easily be altered to a 3-wire 110/220 volt connection. If either appliance develops a defect to blow a fuse, the other receptacle is not put out of service.

RANGE HOOKUPS FOR LOW-COST HOUSING

Wiring details for the new Willert Park, negro housing project in Buffalo, N. Y., provide flexible connections for electric ranges but without employing a removable plug outlet. When a range is installed it is permanently connected to its conductors which cannot be removed except at the range terminal block.

There are about 172 ranges of 7.4 kw capacity to be used. At some range locations the apartment circuit breaker load center is directly above the range, while about 82 ranges are in apartments that have their circuit protective devices grouped in central meter closets.



PLUGLESS RANGE wiring in new housing project, for close-to-panel and remote locations.

To simplify connections, the close-up range "A" shown in sketch employs a No. 8 continuous flexible rubber cord from the range into the load center. A flush 4 11/16 in. square outlet box with bushed cover is placed behind the range. The range conductors enter this box and are pulled up through concealed conduit to the load center. For the type "B" range hook-up, single conductors are installed from the meter closet to the flush outlet and spliced therein to flexible range cord.



No Double Dealing

● Under the T&B PLAN there can be no double-dealing. The T&B PLAN has to do with the operating policies for the conduct of a manufacturing business.

The Thomas & Betts Co. are the first to introduce and advertise a 100%—Distributor—One-Price-Plan to the Electrical Industry.

It is important for you to know that the Distributor who is supplying you can have no different cost, on T&B Products, than the Distributor who is supplying your competitor. All T&B products are sold through authorized T&B Distributors.

T&B favors every Distributor alike. There are no inside concessions.

Under the T&B PLAN every Distributor gets the same deal . . . from the TOP of the deck. A published Distributors cost sheet establishes the basic cost to all.

The T&B Distributor spreads the cost of distribution over many lines. He reduces the Manufacturers operating, warehousing and selling costs. He brings together under one roof, thousands of quality products at a minimum cost to the User. He eliminates guess work, time-wasting, shopping-around and the hazards of inferior merchandise.

Forty years experience have convinced T&B that a 100%—Distributor—One-Price-Plan is the one method of doing business that will bring the thousands of items that T&B manufacture into the hands of the User at lowest cost to the User.

#3

A series of advertisements designed under the T&B Plan to set forth the economic reasons for the fixed T&B Distributor policy.

The **T&B** **DISTRIBUTOR**
SERVES and SAVES

THE T&B DISTRIBUTOR SAVES YOU MONEY BY:

- Reducing estimating costs.
- Functioning as Purchasing Agent.
- Delivering on schedule.
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THE THOMAS & BETTS CO., Inc.

MAIN OFFICE and FACTORY

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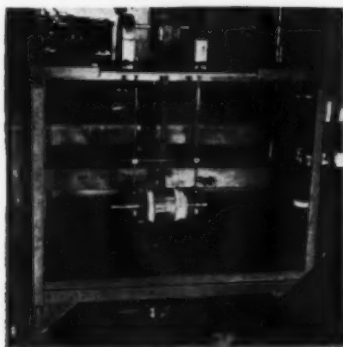
EXPORT DEPARTMENT—BROOKLYN, NEW YORK

ELECTRICAL FITTINGS SPECIALISTS SINCE 1899

Motor Shops

SMALL ARMATURE BALANCER

An inexpensive machine for balancing small rewound armatures is used by the Johnson Electric Company of Staunton, Va. It was made in the shop from odd parts. In use, the armature is brought up to motor operating speed by pressing it against a moving belt. A



TENSION BALANCER—Armature in sling is brought to speed by contact with belt drive.

pencil is held against each end of shaft and necessary weight is added to end of pencil mark. Scraps of rectangular copper wire are used for balancing. The machine is also used for balancing flat and V pulleys.

A frame was made of 1½-inch angle iron, 42-inches wide by 20-inches deep, with 66-inch legs. The top of the bench is 36 inches from floor, allowing 30 inches above the bench for mounting top pulley and cross bar for the armature carrier. The upper parts of the legs were joined on narrow side only.

The cross bar which carries the arms is slotted. This makes the arms adjustable. The arms were constructed from 3-inch threaded machine screws welded to strap hinges. Each hinge is welded to half-inch pipe, 3½-inches long. The extension rod is resting on a spring mounted inside the pipe. A ball bearing carrier is mounted on the ends of the rods for armature. Total overall length

of these rods is 21 inches. The cross rod just above armature is adjustable for armature widths.

The counter shaft revolves at 1,000 RPM. The driving pulley is 8-inches in diameter, giving a belt speed of approximately 2,000 feet per minute in a downward direction. This belt runs over an 8-inch pulley, mounted just back of the cross arm on top of the machine. The two counter shafts are mounted in ball bearings. Pulleys used must be in balance.

STOCK CONTROL

A large motor shop with production line methods must be backed up by a thoroughly efficient material stock control system. The Spaulding Electric Company of Detroit has the entire third floor of its establishment devoted to stock rooms. Thousands of items are controlled through a perpetual inventory card system. Each order for material is charged out on the inventory card when it is delivered to the shop. The quantity of each item remaining in stock is ex-



MATERIAL REQUISITION becomes automatic when inventory approaches the minimum figure shown on the inventory card in this stock control system.

tended after each entry. On each card is a notation indicating the maximum and minimum quantities of the material carried in stock. When the inventory reaches the minimum figure the stock keeper puts through a routine requisition to the main office for the quantity required to bring the stock back to the maximum figure.

QUICK MAKE-READY FOR ARMATURE LEADS

The leads on re-wound armatures are stripped ready for soldering into the commutator segments by means of rotary wire brushes, at the Jacksonville (Florida) Armature Works. A small angle iron stand was provided with an underslung motor that drives ver-



LEAD STRIPPER—Armature leads made ready for soldering by rotary wire brushes.

tically shafted wire brush wheels. Small armatures are chucked on a sliding steel centering bracket or holder. With the new windings leads fanned out all around, the armature is shoved forward while revolving until all its leads have passed between the stripping brushes. A vacuum cleaner motor draws off all thread flyings as they are stripped from the coils.

Because of the simplicity of mounting the armatures for lead stripping, an operator can complete this operation in two to three minutes. Less time is required if a run of similar armatures is handled.

HOW SMALL MOTOR REPAIR CHARGES VARY

A report before the recent NISA Convention, on servicing small motors, pre-

2 G-E Control Systems

That Help You Get Maximum
Hp-Hours from Motors You Install

POWER SUPPLY



System A

MANUAL DISCONNECT SWITCH

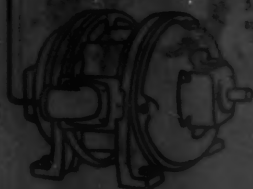
1. *Manual Switch* to disconnect control and motor from power supply.
2. *Fuses (optional)* protect against short-circuit conditions.
3. *Manual Circuit Breaker* (used in place of switch and fuses) facilitates resetting.
4. *Provision for Locking* switch in off position while working on circuit.

G-E MAGNETIC MOTOR STARTER

1. *Protects Operators* by isolating control from power circuits.
2. *Underload Protection* disconnects motor when power supply fails. Operator must press START button to restart—prevents injury to operator from unexpected restarting.
3. *Isolthermal Overload Protection* prevents injury to motor from overheating, yet prevents needless shutdowns due to brief or otherwise harmless overloads.

G-E PUSH-BUTTON STATION

1. *Remots Starting* permits location right at work where convenient. Any number of stations can be used in parallel.
2. *Large Push-Button* make operation easy.
3. *Automatic Operation* with float, limit, or pressure switches readily obtained.



MOTOR—any a-c induction motor that can be started on "full voltage"

POWER SUPPLY



System B

G-E COMBINATION SWITCH

Provides all functions of SYSTEM A:

1. *Manual Switch with Fuses (optional) or Manual Circuit Breaker.*
2. *Underload Protection.*
3. *Isolthermal Overload Protection.*

With these added advantages:

1. *Added Safety* since cabinet cannot be opened unless disconnect switch is open, making all parts "dead" except supply terminals.
2. *Easier Installation.* The single complete control comes ready-wired, so there is only one device to be mounted, and no extra wiring is required.

One optional feature is also obtainable:

1. *Plug Jacks* in cover make it easy to insert testing meters in motor circuit without interrupting operation.

G-E PUSH-BUTTON STATION

Provides same function as push buttons and pilot devices in SYSTEM A.



IN SELECTING a motor, maximum uninterrupted horsepower hours, and characteristics that suit the job are two primary considerations. *These same factors* should govern the choice of its control. The control should provide long life, safety for operators, and correct overload protection. The best way of obtaining *all* these is to specify a G-E control system.

General Electric Co., Dept., 6D-201
Schenectady, N. Y.

Please send me additional data on control for motors. I am interested in:

- ☐ SYSTEM A
☐ SYSTEM B

☐ Push-button Stations

Name

Firm

Address

080-195

GENERAL  ELECTRIC

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**Drug Stores—Grocers
Hardware Stores—Florists
Department Stores
Shoe and Apparel Shops
Bakeries and Candy Shops
and many others**

**depend on YOU
for SALES LIGHTING**

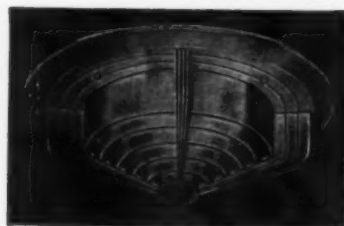
Why not give them the best—up-
to-the-minute lighting for show
windows and store interiors

with

**Sterling
REFLECTORS**

and

STER-LITE FIXTURES



We'll help you—just send us the
data and we'll send you layouts
covering the finest in modern
"Lighting to Sell"



**NEW
STERLING CATALOG**
Write for it.

STERLING REFLECTOR CO
1435 W Hubbard St CHICAGO



[FROM PAGE 28]

sented a cost summary showing the low, high and computed average charges for repairing fractional horsepower motors. This report was compiled from the experience of members. It covers minor and major repairs, and complete rebuilds, for six general classes of small motor work, and also shows the number of motor units involved under each group.

COST SUMMARY OF FRACTIONAL HORSE-POWER MOTOR REPAIRS

Repulsion Induction, Refrigeration & Direct Current Motors.

$\frac{1}{8}$ to $\frac{1}{4}$ HP

Based on 308 Units		Low	High	Avg.
72%	Minor Repairs.....	1.04	2.40	1.66
18%	Major Repairs.....	3.61	5.50	4.75
10%	Complete Rebuilds....	7.86	8.27	7.78

$\frac{1}{4}$ to $\frac{1}{2}$ HP

Based on 152 Units		Low	High	Avg.
73%	Minor Repairs.....	1.51	2.84	2.23
18%	Major Repairs.....	5.99	7.97	7.24
9%	Complete Rebuilds....	11.20	12.90	12.04

$\frac{1}{2}$ to 1 HP

Based on 44 Units		Low	High	Avg.
64%	Minor Repairs.....	1.89	4.50	2.83
36%	Major Repairs.....	6.86	10.60	7.80

Condenser Start Motors
 $\frac{1}{8}$ to $\frac{1}{4}$ HP

Based on 206 Units		Low	High	Avg.
53%	Minor Repairs.....	1.15	3.70	1.10
41%	Cond. Replacements..	1.89	3.35	2.12
6%	Major Repairs.....	3.91	5.40	5.45

$\frac{1}{8}$ to $\frac{1}{2}$ HP

Based on 10 Units		Low	High	Avg.
90%	Minor Repairs.....	1.74	1.77	1.74
10%	Cond. Replacements..	3.05	3.05	3.05

Split phase Motors — Short Hour Duty
 $\frac{1}{8}$ to $\frac{1}{4}$ HP

Based on 122 Units		Low	High	Avg.
75%	Minor Repairs.....	1.03	2.07	1.59
25%	Major Repairs.....	2.29	3.60	3.12

Although this report does not include costs from a sufficiently large number of members to give a true national picture, it provides useful guidance to service shops. The number of repaired motors on which these figures are based is noted on each table.

Signal Electric Mfg. Co.
Menominee, Michigan, U.S.A.
Offices in all principal cities

USE G-E WHITE
For Wiring Protection

G-E White Rigid Conduit provides permanent protection for wiring systems. Made of the finest mild "rimmed" steel — hot-dipped galvanized and Glyptal coated, inside and out. Resistant to heat, flame, gas, acids, alkalis and moisture. Easy to bend and install.

Boxes and Fittings

A complete line of G-E Boxes and Fittings is available.

For further information, see the nearest G-E Distributor or write to Section KM-691, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

Electrical Contracting, August 1939

THEY WANT MORE CHAPTERS

WHEN this series of Maintenance Guide Sheets was launched, we had 18 chapters listed. That sounded like a lot to run through a year and a half.

It sounded like a lot of work, too. For the difficulty is to reduce each discussion to three pages of text and pictures. Six pages would be easy, because the data that we gather is always enough for 12 pages, and the selecting and boiling down is hard. And the preparation of the full page trouble chart or other data is a chore. But we have believed that the value of this review of modern maintenance practice lay largely in its brevity.

But we can not stop, it seems. People have been asking us to add other chapters, further topics. So we have listed eight more themes, of which this is the first. We hope you like the idea. We have the feeling that when the series is finally rounded out, about next March, it will offer the makings of a pretty handy reference book for electrical maintenance men.

This series of articles began in January, 1938, with a frank review of the electrical maintenance man's job. Then came—

1. Alternating Current Motors—Types and Applications
2. Direct Current Motors—Types and Applications
3. Alternating Current Motors—Maintenance
4. Direct Current Motors—Maintenance
5. A.C. Motor Starters and Controllers—Types and Applications
6. D.C. Motor Starters and Controllers—Types and Applications
7. Maintenance of Control Equipment
8. Special Control Problems—Heavy Installations and Maintenance
9. Electric Distribution — Circuit Protection — Power Factor Correction
10. Lighting
11. Electric Heat
12. Electric Welding
13. Interplant Communication
14. Instruments
15. Power Tools
16. Batteries and Rectifiers
17. Electroplating
18. Electronic Devices
19. Circuit Breakers (this issue)
Coming articles will discuss
20. Transformers
21. Equipment for Hazardous Locations
22. Wiring Devices and Cables
23. Drives
24. Elevators, Conveyors, Cranes and Trucks
25. Ventilating and Air Conditioning Equipment
26. Management of Maintenance

ELECTRICAL

Maintenance

Circuit Breakers

Maintenance Aspects

BECAUSE they are often concerned with the control of electric power in large amounts at low and high voltages, most maintenance men are well acquainted with circuit breakers. But selecting this control apparatus and keeping it in operating condition presents many problems. And a review of the background facts that govern circuit breaker selection and application will not come amiss.

Circuit breakers, of course, serve as disconnecting means or protective devices to take care of abnormal conditions on a.c. or d.c. circuits. They are employed (1) to protect service, and (2) to protect apparatus and circuits when overloads, short circuits and grounds occur.

There are two kinds of circuit breakers—air circuit breakers and oil circuit breakers. Their names indicate the medium, air and oil respectively, in which they break an electrical circuit. There are two types—single- and double-throw.

Applications

Single-throw circuit breakers are commonly used for—connecting generators and transformers to buses, protecting feeder circuits against faults and overloads, protecting motors against overloads, protecting branch circuits terminating in distribution cabinets.

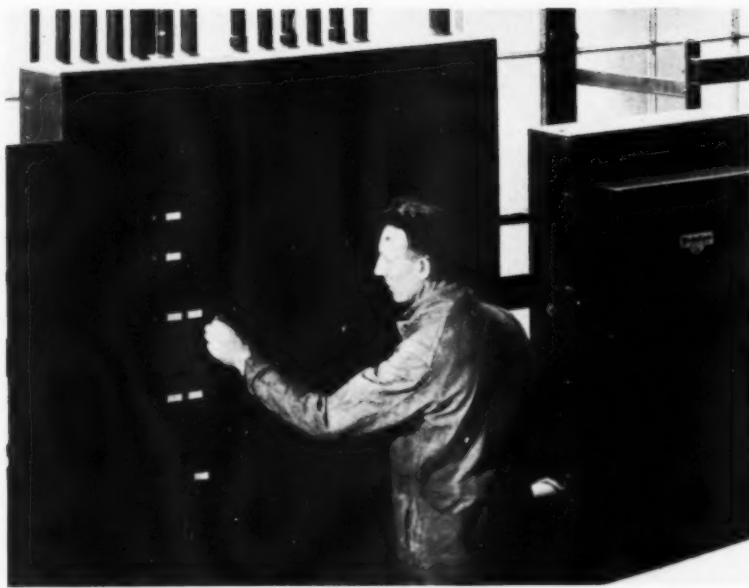
Double-throw breakers are commonly used for—connecting a feeder to either of two buses, starting motors as with auto-transformers, and reversing motors. The number of poles for each breaker is governed by the number of conductors and code requirements.

Air circuit breakers are used normally on a.c. circuits up to 600 volts and on d.c. circuits up to 750 volts. Oil circuit breakers are used only on a.c. circuits. They are not used on d.c. circuits, because it is uneconomical to interrupt a d.c. arc under oil.

Circuit voltage therefore is generally the deciding factor in the selection of either kind of breaker on a.c. circuits. And in general, the oil-immersed type is used on circuits above 600 volts. Below 600 volts either kind of breaker may be used. If dirty, dusty or hazardous conditions exist, oil circuit breakers

LOOKING THEM OVER—For inspection of oil circuit breakers, a rack is used at the Irvin Works of Carnegie Illinois Steel Corp. A 6,600-volt breaker is mounted, with tank removed. (General Electric Co. photo.)





BACK-OF-BOARD AND ENCLOSED air circuit breakers are increasing in use. Trend is away from live-front mounting. In one paper products plant, dead-front breakers have been installed to reduced maintenance on lighting and power circuits. (Westinghouse photo.)

may be preferred or enclosed air circuit breakers may be used.

When circuit breakers are to be used outdoors, they should be properly constructed or housed for protection. This also applies to breakers for substations, manholes and subways. For indoor use, breakers may be the open or enclosed type, back-of-board type, remote on frame work, or enclosed in masonry or steel compartments.

Oil circuit breakers for use on circuits up to 5,000 volts may be mounted on back of switchboard panels. Above that voltage remote control, manual or electrical, should be used and breakers should be mounted in enclosed steel compartments, cubicles, or switch-houses, also with metal-clad switchgear and trucks which can be pulled out for inspection and servicing of the breaker. Enclosures for breakers should be vented particularly for the higher capacities.

Automatic opening of air or oil circuit breakers is generally provided by instantaneous or time-delay magnetic trips. Thermal overcurrent trips are used also on the air-break type. Breakers with the latter method of tripping are for a specific application, to replace and supersede fuses or fused knife switches at distribution and load centers.

Selection

Standard circuit breakers have voltage and normal current ratings based on an ambient temperature of 40 deg. C. and for altitudes up to 3,300 ft.

Unusual conditions such as heat, dust, fumes, gas, moisture, high frequencies, and higher altitudes must be given special attention.

So each application needs a careful study of the requirements, which may be determined by voltage, normal current rating, short-time current rating (for oil circuit breaker), interrupting rating, speed of operation, safety features, methods of operation, indoor or outdoor service, arrangement of terminals, space required, adaptability to a particular arrangement, altitude above sea level, lowest temperature for operation, accessibility for inspection and maintenance, and other requirements.

Interrupting rating is an important consideration in the application of circuit breakers. This equipment must be capable of breaking the current which the system will feed into the fault at the point where the breaker is to provide protection. Calculation for interrupting rate depends on the system connections, but space will not permit going into the details here. However, information on methods of calculation and interrupting ratings for the breakers can be obtained from manufacturers' publications.

Breakers for motors are intended primarily to protect against operating overloads. They must be capable of handling stalled rotor current, but sometimes need not have sufficient interrupting rating to take care of short circuits on conductors from breaker to motor or in the motor. The branch feeder is depended upon for short cir-

cuit protection. There are exceptions such as large motors used in steel mills, and motor-generator sets in generating plants.

There are other special conditions and it is essential that the maintenance man be familiar with the requirements of the National Electrical Code, National Electrical Safety Code, and local codes as they apply to circuit breakers. The standards of the American Institute of Electrical Engineers and National Electrical Manufacturers Association should also be regarded.

Attachments

Depending on application, size and location, circuit breakers are closed either manually, or electrically by a solenoid or a motor supplied preferably by power from a separate source. Opening or tripping is either automatic or non-automatic. If automatic a series overload coil or current transformer trip is used. Attachments employed to meet specific operating conditions are:

1. *Trip-free mechanism* which opens breaker independently of the closing handle so that breaker cannot be held closed.
2. *Instantaneous trip* which opens breaker on overload; calibrated from 100 to 200 per cent of normal breaker rating.
3. *Time-delay overcurrent trip* which delays opening on short-time overloads.
4. *Dual-magnetic trip* which is a combination of both instantaneous and time-delay overcurrent trips.
5. *Undervoltage device* which trips the breaker when voltage fails.
6. *Time-delay undervoltage device* which is set for 2 to 4 sec., during which time, if normal conditions return to circuit, the breaker will not trip.
7. *Shunt trip* which opens breaker electrically from a remote station, regardless of load conditions on the breaker.
8. *Bell alarm* which signals breaker position, usually when tripped on overload.
9. *Reverse-current device* which protects a circuit against reversal of current; calibrated from 5 to 25 per cent of normal breaker rating.
10. *Auxiliary switches* which energize or de-energize circuits for indicating lamps and other devices.

Care

For reliable operation, circuit breakers must be inspected regularly and systematically. Frequency of inspection should be determined on the basis of the conditions of the installation, frequency of operation, magnitude of current interrupted, and any unusual operations which occur occasionally. A maintenance schedule can soon be established based on operating experience.

Before attempting inspection and servicing, or before lowering oil tank, make sure that the circuit breaker and its mechanism is disconnected from both power and control circuits.

In the care of *air circuit breakers*—

1. Make light monthly inspection and a thorough inspection semi-annually.

MAINTENANCE GUIDE SHEET CIRCUIT BREAKERS

TROUBLE CORRECTION CHART

TROUBLE	CAUSE	REMEDY
OIL CIRCUIT BREAKERS		
Poor condition of contacts — Pitting, Freezing	Neglect after many heavy operations Out of adjustment Overloading	Examine more frequently Dress up and adjust correctly. Renew if necessary Remove overload
Mechanism sticking	Poor lubrication Out of adjustment	Lubricate Check adjustment
Burn-out of operating coil	Operator holding control switch in too long Relay sticking	Educate operator. Change connections to include cut-off switch Check relays
Oil low	Leakage or oil throw during operation	Repair to stop leakage. Tighten up threaded joints
Dirty oil	From extraneous dust or from many operations	Drain and filter, or put in new oil
Moisture present	Condensation due to climatic conditions Entrance of water from rain or other source	Drain and filter oil, or put in new oil Remove source of water entrance
Sludging of oil	Overheating or freezing	Renew oil
Gaskets leaking	Improper installation or oil saturation	Clean gasket seats with Carboline to remove oil, and reassemble
AIR CIRCUIT BREAKERS		
Overheating	Contacts not meeting properly Dirty or greasy contacts Contacts pitted and burned Connections to breaker inadequate, or bolts not properly tightened Poor location, in too high an ambient temperature	Adjust properly Clean contacts Dress and fit properly Correct and tighten all nuts Correct
Fail to trip	Worn or damaged trip pin, from neglect and excessive wear	Readjust or replace with new part
Fail to latch (electrically operated)	Out of adjustment due to loosening of mechanism over long period of operation without attention	Readjust and replace worn parts if necessary

SOME N.E.C. (1937) REFERENCES

PARAGRAPH	SUBJECT
100	Definition of circuit breaker.
2306	Control of master service on a property.
2351	Disconnecting all service-entrance conductors from source of supply.
2354	Disconnecting means for service-entrance, may be manually operable, of air-break or oil-immersed type.
2356	Enclosed service circuit breaker, externally operable.
2389	Open all ungrounded conductors, free to open in case circuit is closed on an overload. Indicate whether open or closed.
2405	Open all ungrounded conductors of the circuit.
2432	Time-delay thermal-trip type, rated at not more than allowable carrying capacity of conductors as specified. Time-delay magnetic-trip type, setting not more than 125 per cent of allowable carrying capacity of conductors as specified.
2433	Instantaneous-trip type, set to operate at not more than 125 per cent of allowable carrying capacity of conductors as specified.
2481	Manually operated, not likely to injure operator. Indicate open or closed position, non-tamperable trip point.
3801	Grounded and ungrounded conductors simultaneously disconnected.
3803	Enclosed and externally operable, when adjacent to readily ignitable material, exposed to mechanical injury, accessible to other than qualified persons, exposed to moisture, located in a wet place or outside of a building.
3811	When serving as a switch, have the number of poles required for such switch.
4346	Use as motor-branch-circuit overcurrent protection.
4348	Continuous current rating of not less than 115 per cent full-load current rating of motor.
4407	Serve as both controller and disconnecting means for a motor.
7134	Series trip coils should not be used with panel or panel-frame-mounted oil circuit breakers on circuits exceeding 750 volts.
7135	Enclosure of apparatus exceeding 5,000 volts between conductors.
7136	On circuits over 600 volts, isolated from other apparatus; on circuits exceeding 5,000 volts between conductors, mounted remote from control panel and be metal-enclosed type.



SEPARATE COMPARTMENTS for air circuit breakers. These 300-amp. breakers are solenoid-operated, have draw-out frames for ease of inspection or replacement. Installation is at Boulder Dam. (Roller Smith Co. photo.)

2. If breakers remain closed or opened for a long time, arrange to operate them several times every two weeks.

3. Check main contact for overheating caused by insufficient contact pressure or poor electrical contact. Overheating may be caused also by insufficient lead capacity, hot ammeter shunt too near the circuit breaker, defective contact between parts of conducting material such as nuts, clamping terminals, and bus bars to the studs, or a defective soldered joint.

4. See that contacts have not shifted, that all adjusting screws are tight, that main contacts precede opening of secondary contacts, and that contacts on multipole breakers make and break at the same time.

5. Sandpaper or file pitted or burned copper contact surfaces. Use crocus cloth on silver contacts.

6. To check contact surface, insert thin paper between contact and contact block or stud head and close the breaker. If blank spaces occur in the imprint, carefully remove the high spots.

7. Occasionally check calibration and operating mechanism.

8. Remove dust and dirt from operating parts, also check for binding in closing or opening operation.

9. Renew flexible shunt if arcing occurs between main contact and block, or main contact brush and lower stud head.

10. Smooth off roughened carbons until they make good contact. If cracked or broken, replace them.

In the care of oil circuit breakers—

1. Be sure that the breaker frame is well grounded.

2. Examine all contacts regularly, and especially after severe short circuits. See that contacts are aligned properly and that contact surfaces bear with firm and uni-

form pressure. Copper contact surfaces that are only roughened may be smoothed down with a fine file or sandpaper. Replace badly pitted or burned contacts.

3. See that secondary arcing blocks, if used, make contact on closing, before the primary fingers.

4. Inspect bushing supports as vibration, due to operation of breaker, may cause bushings to move slightly and result in misalignment of contacts.

5. Clean bushings regularly where abnormal conditions prevail, such as salt deposits, cement dust or acid fumes, to avoid flashover.

6. Thoroughly clean all insulating parts; remove all traces of carbon.

7. After making adjustments and before attempting electrical operation, operate the apparatus manually, to determine that there is no binding. Do not force a mechanism which does not operate freely.



A TRANSFER TRUCK permits ease of removal and replacement of oil circuit breakers of large capacity. (General Electric Co. photo.)

8. Do not operate the breaker excessively without oil in the tanks. Before testing, coat main contacts (blades and fingers) with a thin film of vaseline.

9. See that gaskets are in place.

10. Occasionally inspect and tighten the bolts around the bushings.

11. Inspect operating mechanisms and lubricate all bearing surfaces.

12. See that all bolts, nuts, cotter pins, rods, levers and terminal connections are in place.

13. Repaint scratched or damaged surfaces to prevent corrosion.

14. See that oil is kept at the proper level in the tank.

15. Test oil every three months, and especially after severe short circuits. Samples of oil should not be taken until it has remained undisturbed for at least 4 hours.

16. If oil shows signs of moisture, carbonization or dirt, then filter and retest before placing in service.

17. Remove all oil and thoroughly clean the tank of all internal parts at least once a year.

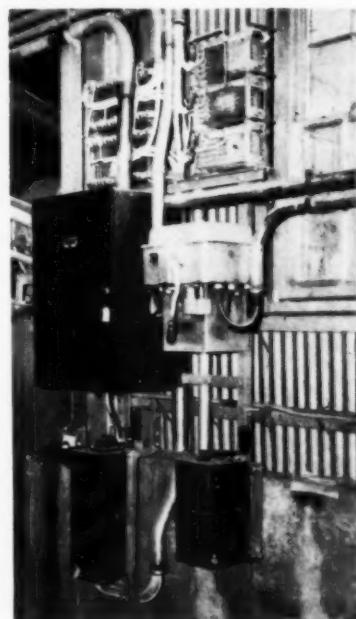
18. Dashpots should be removed twice a year, washed in Carbona or its equivalent, allowed to dry, and filled to half its depth with oil recommended by the breaker manufacturer.

Oil Testing

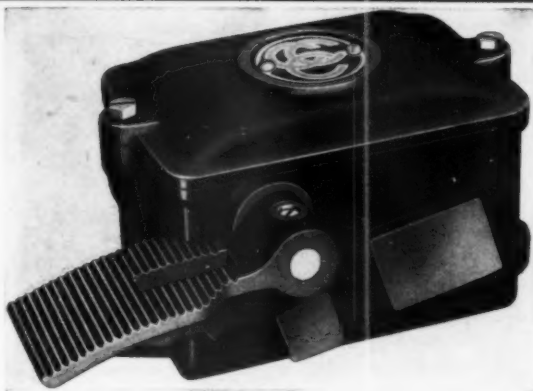
All new oil should be tested immediately before being placed in oil circuit breakers. Samples should be tested in a standard gap and should withstand a potential of 22,000 volts between 1-in. discs placed 0.1 inch apart. Oil that does not withstand the specified potential must not be placed in service, until it has been dried and its insulating value brought up to the above standard, by filtering or other suitable process.

Samples of oil in service should be tested also in a standard gap. The dielectric strength should not be allowed to fall below 16,500 volts. If the tests indicate a dielectric strength below this minimum limit, the oil must be filtered or otherwise cleaned until its dielectric strength is brought up to 22,000 volts. Both measurements to be made between 1-in. discs spaced 0.1 inch apart.

Spare parts should be carried in stock for prompt replacement of any worn, broken or damaged parts. The number and kind of parts will depend on the construction of the breaker. The manufacturer's list will be a helpful guide.



FOR A DUSTY PLACE, as a rock crushing plant. A manually operated oil circuit breaker (at window corner) is used as a starter for 100 hp., 440-volt slip ring motor. Secondary drum controller is mounted directly below and resistor above.



TYPE FS1, FS2, FS3
NO AUXILIARY DEVICES



TYPE FSL1, FSL2, FSL3 WITH STANDARD LATCH

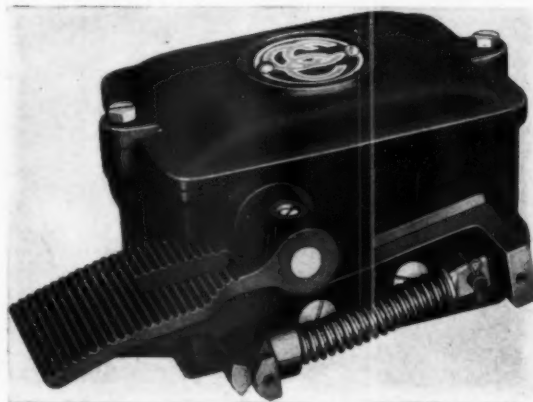
**"3C" BULLETIN 101 FOOT OPERATED
HEAVY DUTY MASTER SWITCHES
5 TYPES AS ILLUSTRATED • 5 DIFFERENT
CONTACT ARRANGEMENTS**

Available with or without latching devices and with or without auxiliary external return springs, these "3C" Foot Switches are sturdily built to provide exceptional service in heavy duty operation.

Contact fingers interchangeable with other "3C" switches; double break silver to silver contacts; oil impregnated main shaft bearings, and at all pivotal points; large electrical and mechanical clearances; and many other features are described in a folder which is yours for the asking.



TYPE FSL1S, FSL2S, FSL3S
WITH STANDARD LATCH AND AUXILIARY SPRING



TYPE FS1S, FS2S, FS3S
WITH AUXILIARY SPRING



TYPE FRL1S, FRL2S, FRL3S
WITH SPECIAL LATCH AND AUXILIARY SPRING

OFFICES IN PRINCIPAL CITIES



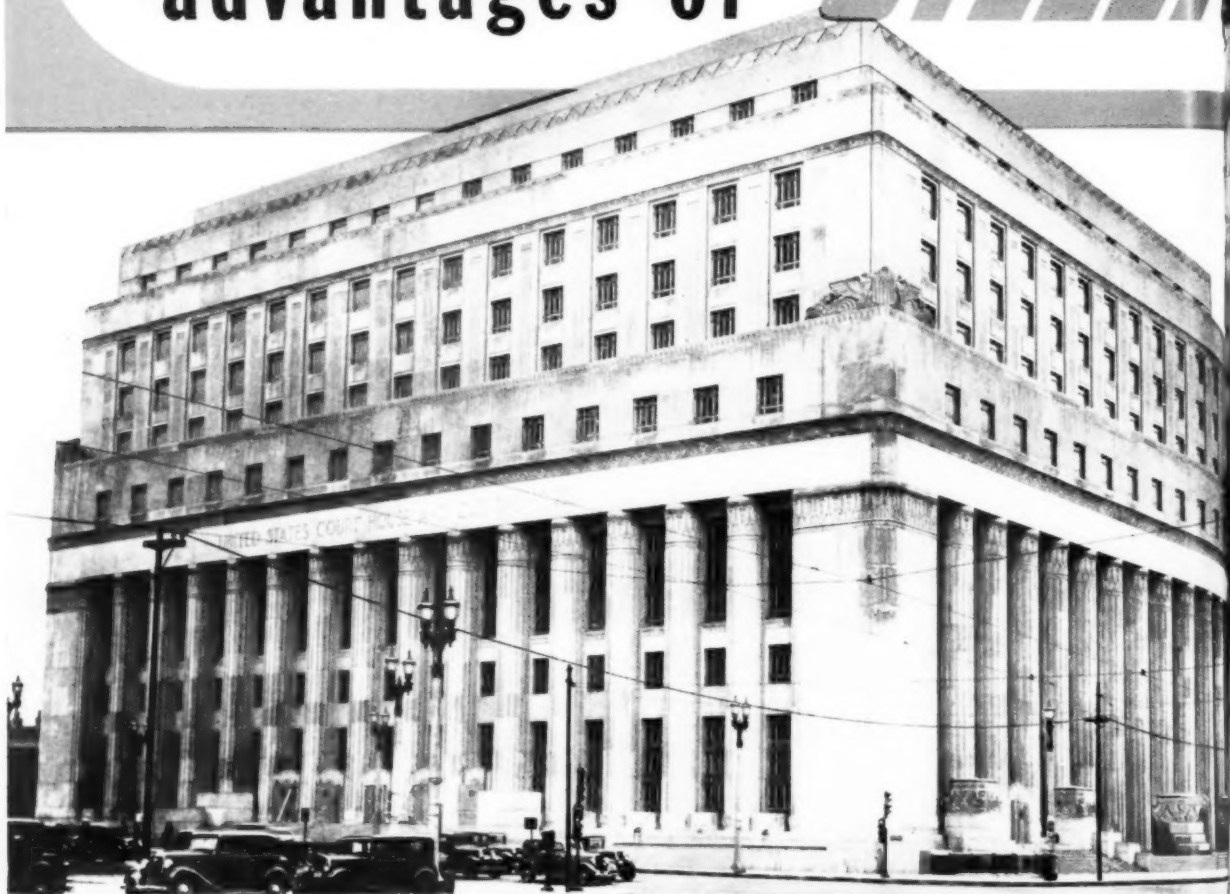
THE CLARK CONTROLLER CO.



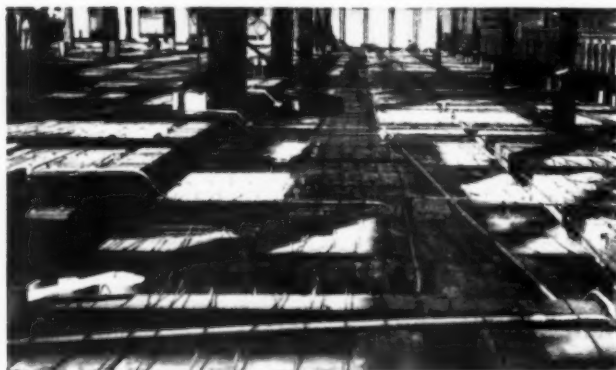
1146 EAST 152ND ST.

CLEVELAND, OHIO

The bigger the job, advantages of **STEEL**



It's on a concrete job such as this—the St. Louis Court House and Custom House Building, in which E. A. Koeneman Electric Co. used 275,000 feet of ELECTRUNITE Steeltubes in assorted sizes—that the many features of this electric resistance welded electrical metallic tubing show to best advantage. Steeltubes makes working in tight places almost as easy as at a shop bench.



...t more you'll appreciate the **STEELTUBES IN CONCRETE!**

● You and your workmen will enjoy using ELECTRUNITE Steeltubes on any job — but it's on the big concrete jobs that you'll really appreciate its ease of handling.

You'll find that backs and arms are relieved of aches — especially when a series of runs are made in one of the difficult, cramped spaces so frequently encountered on concrete jobs. You'll find that the work moves smoothly on schedule — that you worry less about making out on your bid. And when the job is ready, you'll find that wires pull through this modern threadless rigid conduit easily and without trouble.

Try ELECTRUNITE Steeltubes on your next job — either exposed or in concrete. Learn first-hand what it can do to make your jobs better jobs — more profitable jobs.

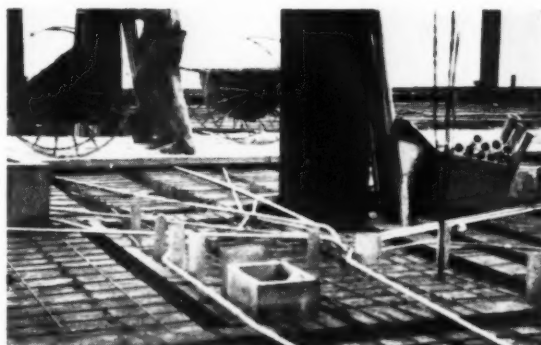
Steel and Tubes, Inc.
CLEVELAND OHIO

SUBSIDIARY: REPUBLIC STEEL CORPORATION

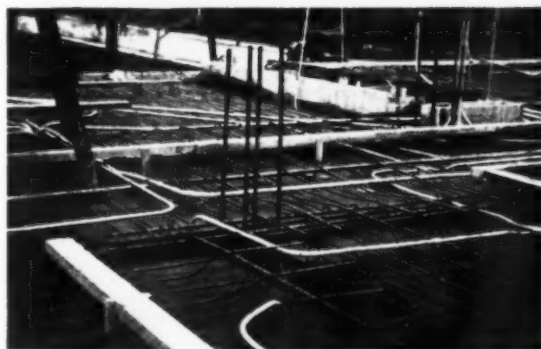


Look for this label. It is found only on genuine ELECTRUNITE Steeltubes.

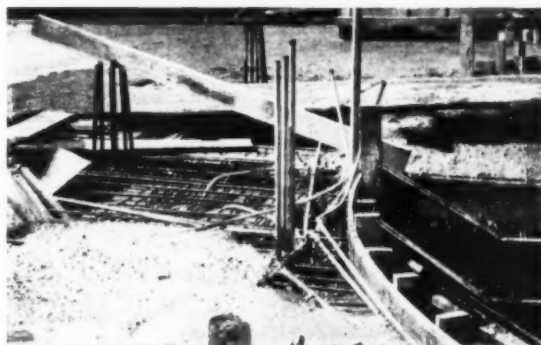
Concrete can't seep into ELECTRUNITE Steeltubes, because the compression-type fittings are watertight. Neither can corrosion gain a foothold, because there are no cut threads, no vise or wrench damage to break the continuity of galvanizing over the entire system. At the right is another E. A. Koeneman Electric Co. job — 20,000 feet of Steeltubes in the Webster Groves, Mo., City Hall.



Though light in weight and remarkably easy to handle, ELECTRUNITE Steeltubes is tough and strong — because it's made of high-quality, open-hearth steel. You can run a wheelbarrow over it without damage.



Workmen who use ELECTRUNITE Steeltubes don't complain when they are faced with a multitude of bends of all shapes and sizes. They merely grab a roll-type hand bender and before long the bends are made, accurately and with little effort.





TIMESAVERS and PROFIT-MAKERS FOR THE CONTRACTOR

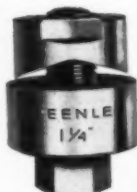


Cable Puller

No longer is it necessary to use cumbersome, heavy equipment for pulling in cable. The Greenlee anchors right to the conduit through which the cable is to be pulled and is easy to handle and simple to operate.

Knockout Tools

Greenlee Punches and Cutters make it easy to enlarge holes in switch boxes, cabinets, etc. They form clean-cut holes quickly and accurately, without reaming or filling.



ASK FOR CATALOG NO. 31E if you don't have a copy. It shows these tools as well as others of interest, such as Hydraulic Conduit and Pipe Benders, Joist Borers, Hydraulic Pipe Pushers and Electricians' Bits.

GREENLEE TOOL CO.
ROCKFORD ILLINOIS

GREENLEE TOOL CO., Rockford, Illinois

Would like information on:

☐ Please send Catalog No. 31E.

Name

Street

City and State

My Jobber is EC8-39

Saves \$1,800 a Year

In an Indiana coal mine, power was being lost. Just where the leak occurred was the problem for the electrical maintenance department.

A graphic wattmeter was connected in the main feeder circuit overnight. The next morning the chart showed that power had flowed continuously during the night when the mine was idle. Then circuit switches were opened one at a time.

The loss was in the line to the main shaft. When the ground in this circuit was found and removed, a waste of over \$1,800 per year was stopped.

Placing Motor Starters

In many cases the actual position of an electric motor is determined by the location of the machine or line shaft which is to be driven. The position of the motor starter is left often to the judgment of the electrician, perhaps with some suggestions from the operating department. Whoever is responsible for the placement of the starting box is not always to be blamed for many of the poor examples which can be found in many plants and buildings.

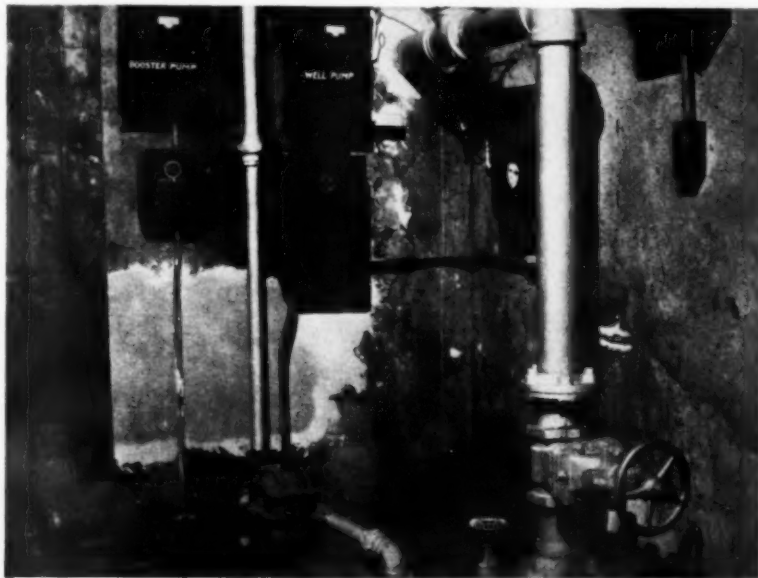
Sometimes the original position was the best but because of alterations which did not include relocating the starter, the conditions have changed. The starter may be located now in a very poor place.

The sequence of disconnect switch, fuses or circuit breaker, starter and motor is fixed by the code and there is rarely an installation which does not comply. It is the physical position of the starter and starting buttons which furnish a fertile field for change.

As an example—For an exhaust fan installation, the starter was placed in full view of workmen, at the correct height on the wall and about twenty feet from the motor. Some time later a partition was erected between the motor and the starter. The space in the vicinity of the latter was used as storage for special sand. No one thought of replacing the starter. Consequently, the operator had to climb over the sand to get at the starter, and from that place he could not observe the motor. Finally the starter was moved nearer to the motor, where it belonged.

In another case, where a synchronous motor was located in a separate house, the starting panel was located in such a way that the opening of a double door partially blocked access to the panel. To facilitate the starting operation, one door was closed and nailed, and the other was left free to open. If the door which blocked the panel had been left to open, and if someone entered just as the motor was being started, an accident might have occurred. Also, if the door had been free to swing, it might have interfered with the operation of the breaker on overload.

Another bad feature of the same installation was the fact that the employee when operating the switches, had to stand directly in line with a 20-in.,



NEATLY MOUNTED STARTERS and pushbutton but they could have been better arranged for accessibility. Control for well pump might have been located on adjacent wall and nearer to pump at valve in lower right corner. Pushbutton above valve is for a fan located to right of pump. Fan and pump are not shown.

4-ply belt. This was a dangerous position for both the operator and starting panel in case the belt happened to break. Sometime later when the plant was not in operation, the starting panel was placed on the opposite side of the motor house. The relocation eliminated interference from the door and provided a safer position for the operator when starting the motor.

Considerable thought and care should be given to the locating of motor starters, with a view not only for the present but to what possible changes may be required in the future. The starters should be conveniently located and safety should be kept in mind at all times.

Heating Cable for Testing Samples

An installation of electric soil-heating cable has been made at The Master Builders Co. laboratory, Cleveland, to assure accurate compressive-strength tests on samples of concrete admixtures.



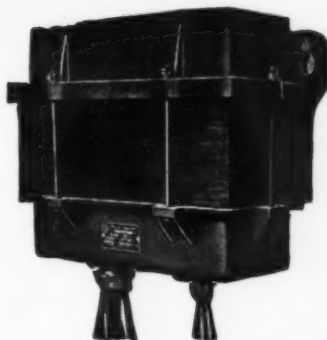
SOIL-HEATING cable has another use. Here it is installed for controlling temperature in a room where concrete admixtures are cured and tested. (General Electric Co. photo)

Tests must be made in a controlled-atmosphere chamber. The room is kept at approximately 70 deg. F. and 100 per cent relative humidity. Small samples are cured in this atmosphere and tested at predetermined intervals over the period of a year.

Formerly, a water bath was used to keep the samples at a constant temperature, but it proved cumbersome and generally unsuited to the job. The water system was replaced with five lengths of electric heating cable which were placed about the base of the test room. A thermostatic bulb to automatically regulate the temperature was placed inside the room. Heater controls were mounted outside the laboratory. Water sprays in the top of the test room keep the humidity at the desired 100 per cent.

E. W. Scripture, Jr., chief chemist of the company, says: "This arrangement gives us positive control of tem-

MERIT



Above: Type CFT, three-phase, outdoor-type, air-cooled, general-purpose transformer.

Below: Type CF, Single-phase, outdoor-type, air-cooled, general-purpose transformer.



Whenever it is desired to obtain a low-voltage supply from a higher voltage circuit you will find AmerTran Type "CF" Air-Cooled Transformers both economical and convenient to use. These moderately priced units may be installed wherever they are needed—either outdoors or indoors*—without the necessity of oil, fire-proof vaults or enclosures. All sizes are equipped with either conduit fittings or a built-in junction box to facilitate installation, and both single-phase and polyphase types are furnished as a single unit. Available in capacities up to 100 Kva. and for potentials up to 2400 volts, all ratings offer low initial investment, minimum installation and maintenance expense, and low operating cost. Let us send data on equipment to meet your needs. Ask for bulletin 1116A.

* Units rated 15 Kva. and larger for indoor service only.

Type "CF" Applications

1. Stepping down power circuit voltage to 115/230 volts for lights, small motors or heating elements. In this way advantage may be taken of lower power rates for low-voltage loads.
2. Obtaining a 3-wire circuit from a 2-wire system.
3. Changing from 3 phase to 2 phase, or vice versa, on a power system.
4. Obtaining low voltage for heating, welding, 32-volt tools, special lighting, testing, etc.
5. Balancing load on 3-phase systems.
6. Insulating one circuit from another.
7. Distributing power at 600 volts or less.
8. Reducing light flicker.
9. Obtaining special voltages to permit efficient operation of equipment.

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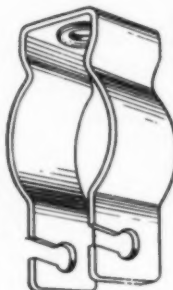
American Transformer Co. manufactures transformers for every industrial, electronic and laboratory application in sizes up to 10,000 Kva and for potentials up to 132 Kv. Other products: voltage regulators, test sets, rectifiers.

HANGER CLAMPS

for Cable, Conduit
Outlet Boxes, Fixtures

AIR CONDITIONED — Adequate air space between pipe and ceiling prevents rust or rotting in damp weather.

SLOTTED — makes installation simple and fast. Bolt and nut may be previously threaded eliminating "3rd hand."



Make a standard practice of asking for PAINE Products on every installation and construction job because within each Paine Product is embodied exclusive design features, superior workmanship, and quality materials.



FLAT BASE CABLE CLAMPS

Wide flat base with hole at either end for convenient installation. An accurate snug fitting clamp that gives utmost satisfaction and trouble-free service. Galvanized or black enamel finish.

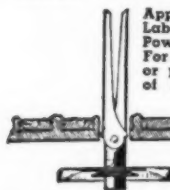
Choice of Paine Patented bolt slot or round Bolt Hole.

IMPROVED CABLE CLAMPS

Preferred for use on cross arms, poles, etc. With malleable shield, they may be used in brick, concrete, and similar material. Gimlet pointed lag screw is riveted into the clamp base. Entire assembly is thoroughly galvanized and quarantined to give strong, secure and satisfactory service. Galvanized bolts furnished with all clamps.



OUTLET BOX and FIXTURE HANGER



Approved by Underwriters Laboratory and Hydro-Electric Power Commission, Canada. For any tile, metal, lathe or plaster ceiling. 11 inches of holding length (two 5 1/2" wings) slip thru 1 1/8" hole, lock open with

patented key that may be unlocked with screw driver if removal of fixture is desired. Unmatched for utility, ease of installation and rugged construction.



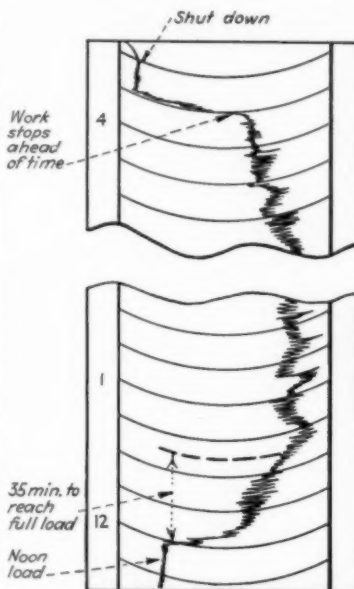
Write today for the complete PAINE Catalog of Anchoring Devices for building and installing, and maintenance and electrical specialties —each an improved, guaranteed product.

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peratures with the maximum of efficiency and the minimum of equipment. Thus electric heat is enabling our laboratory to make the accurate tests which help us manufacture high-grade concrete admixtures."

Work Starts and Stops—When?

A graphic chart showing the current drawn by motors driving machines was obtained at a Milwaukee manufacturing plant. A study of the chart showed that 35 minutes were consumed after lunch in getting up to normal opera-



THIS RECORD shows how labor losses may be detected. It took 30 min. to get going for full production after lunch, and quitting started at 4 P.M. instead of 4:30 P.M.

tions. Also, although the plant closed at 4:30 o'clock in the afternoon, shutting down actually began at 4:00 p.m. and consumed half an hour. The engineer who charted these facts estimates that this loss of time amounted to approximately \$100 per day or \$30,000 annually.

Automatic Battery Charger For Fire Trucks

Recently the problem of providing facilities for charging storage batteries on fire-fighting equipment trucks was referred to the electrical department of the city of Manitowoc, Wis. A study showed that the layout must be simple and fool-proof and provide for disconnecting the charging supply when the fireman attendant pulls out the exten-

"DRILLED 400 HOLES (7/8" dia.) in concrete slabs IN 2 DAYS!"

—Writes Virginia Contractor (Name on Request)

For All
Battery Elec-
tric Portable
Drills

New Drill Goes Through Tile,
Concrete 50%-75% Faster
Stays Sharp Up To 50 Times Longer

Have you tried Carboloy Masonry Drills—the new outstanding drill point for concrete, tile, porcelain, etc.? You do the job faster, more accurately, and eliminate all noisy hammering or hours of monotonous chiseling! It's the perfect drill for installing expansion anchors quickly and easily. No ragged holes! No objectionable noise! No frequent interruptions to change dull drills.

Carboloy cemented carbide—a new metal harder than the hardest steel—now makes this amazing performance possible. Ask your dealer today—or write for leaflet.

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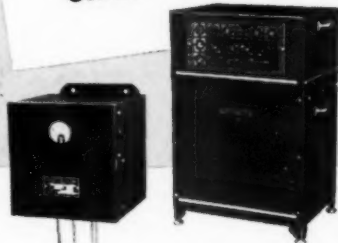
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Quick-Profite
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USE G-E TUNGARS
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G-E Tungar and G-E Copper Oxide Battery Chargers and Rectifiers are available in many types and sizes to provide dependable and economical power supply for practically any direct current application. G-E Copper Oxides have no moving parts to wear out. Tungar Battery Chargers are equipped with genuine Tungar Bulbs.

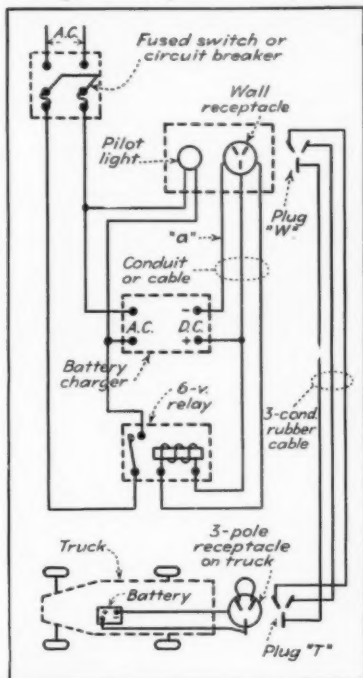
For further information, write to Section KM-691, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

sion charging plug. Furthermore, in case the charging extension cable was plugged in and the attendant forgot to remove it, the plug must pull out of the receptacle when the truck starts out of the firehouse.

The accompanying connection diagram shows clearly how these conditions were met. The connecting or extension cable to the fire truck is plugged into a 3-pole receptacle mounted on the station wall, facing crossways of the truck. A second 3-pole receptacle is mounted on and faces to the rear of the truck, so that the plug will pull out easily when the fire truck or engine starts forward.

Material assembled to complete the hook-up, including alternatives for in-



CONNECTION DIAGRAM for charging batteries on fire trucks. Battery charging starts when plugs "T" and "W" are inserted in receptacles. All circuits are opened if one or the other plug is pulled out, either manually or when fire truck starts forward.

stallations to be made by other fire departments, consisted of a suitable battery charger, a 115-volt red pilot light, two 3-pole porcelain or bakelite 15-amp. receptacles, two 3-prong plugs, a 6-12 volt single- or double-pole relay, a 3-conductor No. 12 rubber covered cord, a 15-amp. dead-front cutout switch for a.c. supply, and rubber covered coded wire. The wiring was installed in steel tubing, handy boxes and 4-in. outlet boxes, strictly conforming to the National Electrical Code. The 115-volt a.c. supply was fused at 6 amp. This particular set-up can be used to charge 6- or 12-volt batteries, but the a.c. supply must be properly fused.



IT is just as easy to install a Bunting Electric Motor Bearing as any other made for that motor. But the Bunting Bearing stays in longer. Available from stock for all makes of electric motors from 1/50 hp to 100 hp. Write for catalog. The Bunting Brass & Bronze Company, Toledo, Ohio. . . Warehouses in All Principal Cities.

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BULLETINS
TELL YOU HOW TO
SELECT THE RIGHT
WAGNER MOTOR FOR
EVERY JOB**

Wagner fractional-horsepower motors are completely described and illustrated in 52-page Bulletin 177. It also contains scores of illustrations, cut-away views, cross-section drawings, speed-torque curves, etc.

Wagner integral-horsepower motors are completely described in 70-page Bulletin 182. It also includes a complete discussion of the seven electrical types of squirrel-cage motors, totally-enclosed fan-cooled motors, explosion-proof, multi-speed, slip-ring and Fynn-Weichsel motors.

Wagner single-phase and direct-current motors are fully described and illustrated in 18-page Bulletin 179. It also contains valuable information on the larger sizes of Wagner repulsion-start-induction motors, repulsion-induction and direct-current motors.

Every electrical contractor should have these Bulletins. They're FREE. Write for your copies today.



Wagner Electric Corporation

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MOTORS • TRANSFORMERS • FANS • BRAKES

No. 605
B-M INDENTER



B-M CONNECTORS and COUPLINGS

No lost time or complicated installation troubles with B-M Connectors and Couplings—that's the reason for their popularity with so many contractors. Just two squeezes on the handles of the B-M Indenter and the B-M Connector or Coupling is securely fastened to the Electrical Metallic Tubing. You save enough on your first job to pay for the B-M Indenter.

Our tools and methods are patented and we limit the license of our tools to the installation of our fittings only. Listed by Underwriters—see your wholesaler or write for further details.

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Color tells the size
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With built-in thermal time-lag element
KLIPOK CLAMPS
Lock fuses and clips together
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For heavy duty testing
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For safe handling of fuses
AUTOMATIC OILERS
For motors, line shafts, etc.

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TRICO FUSE MFG. CO., MILWAUKEE, WIS.
In Canada—IRVING SMITH LIMITED—Montreal

TRICO FUSES
STOP WASTED KILOWATTS AND WASTEFUL SHUTDOWNS

The method of operation is as follows: The a.c. circuit switch is closed. Extension cable plugs are inserted into wall and truck receptacles. Current from the truck battery feeds back to relay coil which closes relay contactor and a.c. circuit to the tube charger. The charger starts immediately to charge the battery. If either plug is pulled out, the 6- or 12-volt d.c. circuit is opened to the relay coil and the contactor opens the charger circuit.

The battery may be protected against faulty discharge in case trouble develops at the battery charger, by using a reverse current relay in leg "a" of the wiring, and running the a.c. supply circuit to the relay contacts. The relay should be, of course, the manual reset type so that trouble must be found before the circuit is plugged in again and the a.c. circuit closed.

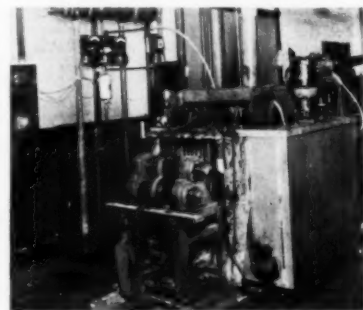
In the fire department where the above installation was made, the battery on each truck is checked every day. Any battery that shows undercharge is plugged in immediately, and connections are maintained until the electrolyte tests normal, by a fully charged battery.

Electrically Heated Oil and Air

At the Diamond Chain and Mfg. Co., Indianapolis, Ind., chains are lubricated and excess oil is removed by electric heat. Before the chains are packed for

shipment, they are immersed in a tank of electrically heated oil. Then, as the product leaves the tank, the excess oil is removed by a blast of compressed, heated air.

The lubrication tank is constructed of ½-in. sheet steel, with three inches of



CHAIN LUBRICATION before packing for shipment. Chains are immersed in oil heated by strip heaters. Excess oil is removed by blasts of air, heated by immersion units installed in air tanks. (General Electric Co. photo)

magnesia on the bottom and sides. Sixty-six strip heaters, in six sections and totalling 39 kw., are clamped to the bottom and walls. Temperature of the lubricant is regulated automatically by a thermostat.

For supplying the heated air, two 550-watt immersion heaters are built into a specially constructed cylindrical tank. A three-heat switch and automatic thermostat eliminate the necessity of manual control.



SUPER-MARKET VENTILATION—Two Albers Super-Market stores in Cincinnati were recently altered to accommodate their occupancy. Grilles were placed in the ceilings. Instead of depending on natural ventilation, 11g power driven ventilators were mounted and enclosed on the roofs. Air is drawn from the stores up through the attic space, and customers like it.

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of

smooth sailing
with
TRIANGLE



New Plant of **INDUSTRIAL RAYON CORPORATION** at Painesville, Ohio

Mr. Contractor:

14 acres of plant! — Windowless! — Air Conditioned! — Cost 11½ millions!

Materials *had* to measure up to the standards set by this plant!

So — **TRIANGLE materials were selected again!!!** Black Enameled Conduit!!

Rubber Covered Wire!! Varnished Cambric Cable!!

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TRIANGLE CONDUIT & CABLE COMPANY, INC.

Horace Harding and Queens Bvds.
Elmhurst, New York City, N. Y.

Questions ON THE Code

Answered by
F. N. M. SQUIRES

Chief Inspector New York Board of Fire Underwriters

Color Code for Grounding

Q. "For grounding fixed and portable equipment (2559-5260) reads: 'By a grounding conductor run with circuit conductors in wire assemblies. This conductor if covered shall be finished to show a green color.'"

"Does this mean that a green color conductor shall not be used as an ungrounded circuit wire? Sec. 2104—Multi wire branch circuit—color code does not mention a green color."—J. P. R.

A. While the present Code does not preclude the use of the green color conductors in circuit wiring, there has been some discussion of this and probably some future issue of the Code will reserve the green coloring for equipment grounding conductors which will then be in keeping with the present Code rule, which prohibits the use of a white color wire for other than the grounded circuit conductors. It will be well, therefore, to reserve the use of green colored wires for the grounding conductors so as to avoid confusion.

Induction

Q. "If a pipe contains two wires carrying current in one direction and a third wire carrying current in the reverse direction, will the induction in the pipe be the same as if only one wire were run through the pipe?"—E. R. W.

A. If the current carried over the various wires within a conduit is equal in both directions, there will be no induction set up in the conduit.

For instance, if we have three wires within a conduit, one of which is carrying 10 amperes in one direction and the other two carry each one-half of

this current, or 5 amperes each—or any other division of 10 amperes—in the other direction, there will be no induction.

Yard Spans from Pole Service

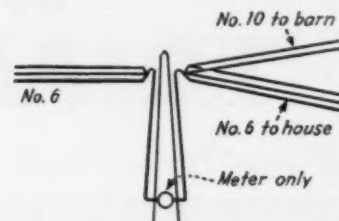
Q. "An extensive R.E.A. project is getting under way in our county. All wiring is required to comply with Code. At the same time they are recommending the use, wherever possible, of a yard pole meter set-up, which will consist of socket meter on pole, using three 6 entrance cable down to meter and back up pole, or three No. 6 wires in conduit may be used down and up."

There will be no fuse or switch at the pole. The question arises if under these conditions all wires leading to va-



PROJECT SUPERVISOR H. G. Bryan of the Illinois Rural Electric Company, REA Co-op with headquarters in Winchester, Ill. operates the only Rural Electrification Cooperative in Illinois with its own generating plant. All connected farms on the 1,000 miles of distribution line must pass a rigid electrical inspection. National Electrical Code is the minimum standard with additional adequacy provisions required under the co-op's rules.

rious buildings would be required to be of No. 6, unless separately fused at pole. Wires leading to house will usually be No. 6 to take care of range load. Those leading to other buildings may, in some cases, be as small as No. 10, where they supply a single branch circuit as permitted by Section 2305c. See sketch."—V. W. M.



A. In this case, fuse protection at the pole is not provided and the service wires to each building from the pole may be different sizes, providing each set is of sufficient capacity to carry the load to its building and provided, of course, that no service wire is smaller than No. 8. No. 10 service wires are not permitted except when supplying a building having but a single branch circuit as permitted by Section 2305c of the Code. But as for the jumper at the top of the pole, the ruling is the same as given in the July 1938 article.

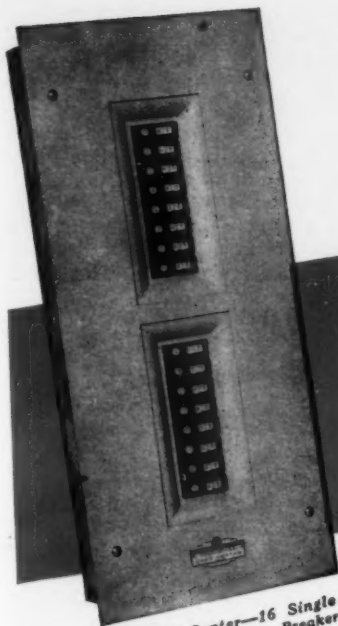
If the wires are run in a conduit or armor of magnetic material, the neutral must be run within the same armor as the other wires and the jumper would not be permissible. But, if the wires are run down the pole as open wires or in non-magnetic conduit, such as brass, or in non-steel clad service entrance cable, the neutral need not be carried down the pole, unless needed in the meter for a potential tap, but may be jumped across the top of the pole. Of course, there must be a service entrance switch located where the service wires enter each and every building.

Bathroom Lights

Q. "Are bracket lights over lavatory with chain pulls connected to convenience outlets, not on switches, safe for bathrooms?"—N. K. McA.

A. Sections 4105 of the Code specifies that "ungrounded metal lighting fixtures, lampholders and receptacles shall not be installed within reach of bath tubs and shower baths. Such fixtures shall not be within reach of plumbing fixtures, steam piping or other grounded work of the premises" and the same rule specifies that "metal pull chains used at these locations shall be provided with insulating links."

A fine print note to section 4127

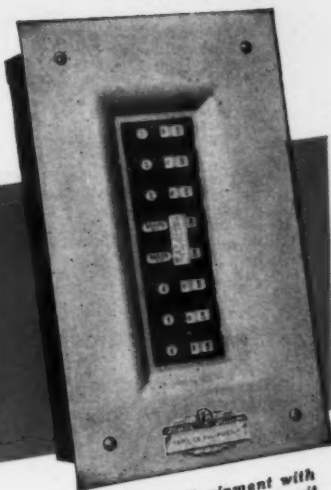


Ⓐ Load Center—16 Single Pole Ⓐ AC Circuit Breaker Branch Circuits

Easy...!!..

TO CHANGE CIRCUIT CAPACITIES

If changes in branch circuit capacities are required, any Ⓐ AC Circuit Breaker can be interchanged by removing only two screws, and inserting a breaker of the desired capacity.



Ⓐ Service Equipment with D. P. 50 Amp. AC Circuit Breaker Main and 6 S. P., AC Circuit Breakers.

Contractors are Showing a Big Preference for this New Ⓐ AC Circuit Breaker Type SERVICE EQUIPMENT AND LOAD CENTERS

Here's the popular equipment that's going over big with home owners . . . It's easy to sell — easy to install — and has many features of strong appeal:

Positive, automatic protection against short circuits and sustained overloads . . . No needless circuit interruptions when momentary overloads occur . . . No more "groping in the dark" to restore service . . . Merely return the handle to the "ON" position, after the cause of the short circuit has been removed . . . Operates manually, like an ordinary tumbler switch . . . Unusually attractive appearance . . . Fits on the job — easy to install . . . Ample wiring space . . . Priced right!

For 120 volt AC service . . . Capacities: 15, 20, 25, 35 and 50 Amp. . . . Approved by Underwriters' Laboratories . . . Send for New Bulletin No. 58 . . . Frank Adam Electric Company, St. Louis, Mo.



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AC CIRCUIT BREAKER TYPE**

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politically, is the Bellevue.
Here vital things happen,
outstanding events are
held — and important
people stay. Reason-
able rates always.

HEADQUARTERS

NATIONAL
ELECTRICAL
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ASSOCIATION

October 9—10—11



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you see the real PHILA-
DELPHIA, a combination
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and the progressive
spirit of the day.

"BELLEVUE" STRATFORD

IN PHILADELPHIA

Claude H. Bennett, General Manager



[FROM PAGE 42]

contains the following suggestions, "Fixtures made of insulating material and lampholders with shells of insulating material are recommended for use with wiring systems that do not afford a ready means for grounding the exposed non-current-carrying parts of fixtures and lampholders."

When fixtures are within reach of other grounded materials such as, water pipes, faucets or stoves and are either grounded or made of insulating materials, and that any pull chains have insulating links, then danger of shocks being received by persons is not considered likely to occur. The use of switch control is to be recommended.

Grounding in Outbuildings

Q. "A question has come up in regard to grounding in outbuildings. Is there a code rule which states definitely when and under what condition an outbuilding should be grounded? Some tell me that when there are 35 feet or more of wiring in a shed, garage or barn or other outbuilding, it requires a separate ground according to Code rules. I fail to find such a rule although Sec. 2536 refers to grounding of other buildings."—A. C. B.

A. Evidently there is confusion here between system grounding and equipment grounding. Sections 2504 and 2505 together with Sections 2533 and 2537 require that the neutral wire or an identified wire of interior wiring systems be grounded. For a.c. systems they must be grounded only at each service, except that for outbuildings, served by a master service



RELICS AND HAZARDS—Inspectors educational booth at Boston's Electrical Trade Show was well bedecked with antique devices and samples of damaged materials. It was sponsored by Eastern New England Chapter, IAEI, and drew a steady crowd of onlookers. Walter M. Carroll, inspector of wires from Brockton was in charge when the camera clicked.

and fed by overhead lines, the neutral or identified wire may be grounded at the entrance to each outbuilding.

Now for the equipment grounding; the requirement for this is found in Sections 2511 to 2518. In Section 2512, we find that runs of conduit less than 25 feet, which are free from probable contact with ground or grounded objects and guarded from reach of persons in contact with grounded surfaces, need not be grounded.

Water Pipe As Conductor

Q. "Please advise if it is permissible to use a water pipe as a conductor from one building to another?"

"I have a three wire entrance 110-220 volt neutral, grounded to city water pipe in main building and at transformer station. This entrance is fused with 60-amp. fuses. I have an outside building about 400 feet from the main building to be wired through the light meter in the main building, and the water is piped from the main building to the outside building.

"Can I run two wires from the main building to the outside building and tap to the water pipe for a 110-220 volt circuit in the outside building?"—L. M. J.

A. The answer plainly is "NO." The National Electrical Code does not recognize the use of water pipes or other piping as a neutral conductor. It will be necessary to provide a neutral conductor for the outside building.

Testing for Polarity

Q. "After wiring several farms, our helper installed the fixtures after which one of the utility company men came along and proceeded to test all individual lamp sockets finding a few reversed polarities here and there. We were told that such must be corrected before the customer could be served. Is this good common sense? Is such a test required? Does it come under Inspectors' rule?"—A.L.V.A.

A. This most certainly is a good common sense rule and comes under the Inspector's jurisdiction. This is especially so as it is a preventative of personal injuries as well as of fire hazards.

Article 200 of the Code requires that all interior wiring systems shall have an identified grounded wire and Section 2004 requires that this wire, if run to a lampholder, shall be connected to the screw shell. Any Inspector or company would be very foolish not to enforce strict compliance with this rule.

Electrical Contracting, August 1939



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Architects, contractors, electricians and builders have all placed their stamp of approval on **RACO • ALL-STEEL • PRODUCTS**. In winning this nation-wide acceptance, these products have proved their efficiency in meeting modern wiring requirements economically. They present many advantages in the steadily increasing rural and urban modernization markets as well as on new jobs.

Competent engineers have developed **RACO • ALL-STEEL • PRODUCTS**—keeping pace with the changes in wiring trends and in building into their products features that increase

efficiency and comply with local conditions and requirements. These improvements are important to everyone in the building and electrical industries, for they help save time and increase income.

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OLD WORK SWITCH BOX
for mounting in a rewiring or modernization job.

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SWITCH BOXES
The MC, used in old or new work. The Switch Box you need is in the **RACO • All-Steel** Line.

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"HI-LO" BARRIERS
for the separation of differing voltages.

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UTILITY or HANDY BOXES
for surface wiring—old or new work.

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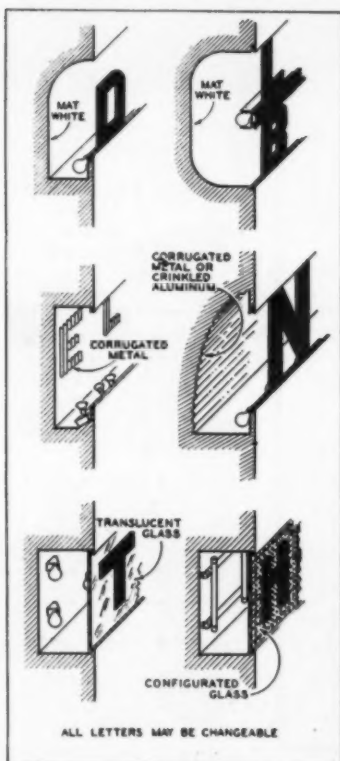


EXTERNAL MOUNTING EARS
for Outlet Boxes. Any type of **RACO • All-Steel** Octagon Box will be furnished with External Mounting Ears on special order.

Better Lighting

DISPLAY SIGNS

The space over theatre lobby doorways is a good space to bulletin coming attractions. This space may be effectively used with a simple ledge or cove to light the upper wall against



THEATRE SIGNS—Simple construction for cove and high box signs.

which cut-out silhouette letters and designs may be shown. But the light-box or recessed cavity is perhaps of greater value because of its adaptability to various installation conditions. The sketches show several practical arrangements of lamps with reference to cavity form and method of mounting changeable letter copy.

The ticket booth is another valuable location for attention-compelling display. It is the theatre's first direct point of contact with the public. Luminous panels built into the sides of the booth are particularly effective in attracting attention, if maintained at a high brightness. They serve as a ready-made background for silhouette copy, permanent or changeable, giving prices or further details of the performance.

QUANTITY VS. QUALITY IN LIGHTING

The quantity of light required for a task depends upon the work being done, the degree of accuracy, the fineness of the detail to be observed, the color and reflectivity of the work. In a broad sense, the efficiency of a lighting system is to be judged by the seeing ability which is obtainable, not simply the footcandles which are secured from a given watts per square foot. Here is visual proof of this fact.



LESS LIGHT—BETTER SIGHT—Demonstration of importance of quality of light. Half the intensity here makes plainer reading.

The top picture shows a micrometer lighted to a level of 200 footcandles from a concentrating type source. Reflected glare makes it practically impossible to read the scale. The lower picture shows the same micrometer lighted to 100 footcandles by a source of large area and low brightness. The ease with which the markings on the barrel can be seen, even though the quantity of light is half that provided in the first instance indicates the extreme importance of "quality" in lighting.



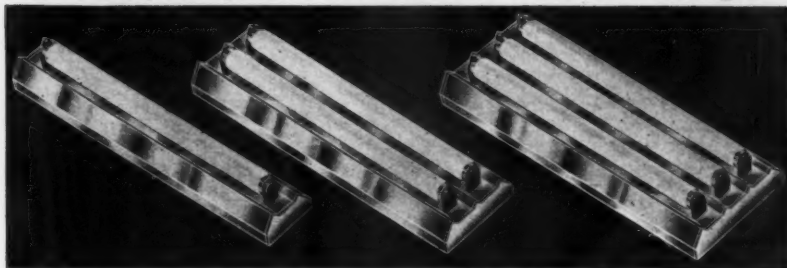
LOW CEILING TRICK—The Woolworth Store in Milwaukee had an 8 to 10 ft. ceiling problem. They found the answer in special Curtis fixtures designed for the bay corners alongside by air ducts. Four horizontal openings and downlighting lenses give glareless light.

DAY-BRITE FLUORESCENT LAMP FIXTURES

A Fixture for Every Application

DECORATIVE SURFACE FIXTURES

For 18", 24", 36" and 48" Fluorescent Lamps



For one, two and three rows of lamps — 18", 24", 36" and 48" size. These fixtures are available as single units as shown above and in continuous lengths. Finished in polished chromium and complete with sockets and auxiliaries, wired ready for installation.

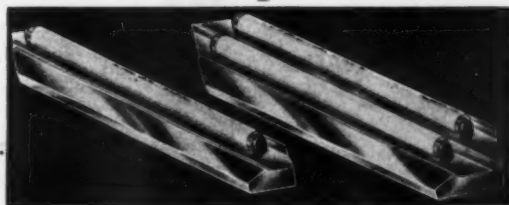
For Bathrooms and Dressing Rooms — One-light fixtures have excellent applications over or on each side of bathroom or dressing room mirrors. They can be furnished with switch and convenience receptacle as shown at left.



Mitered Corner Blocks — For use in connection with these fixtures to form various designs, in squares, oblongs, angles, etc., are shown at right.

Fixtures with "V" Shaped Ends

These fixtures are available in one and two lamp units for 18", 24", 36" and 48" lamps. Their shape will permit grouping in various unusual designs for decorative effects.



WRITE TODAY . . . for your copy of Day-Brite Fluorescent Catalog No. 110. It fully describes the complete line of fixtures for Fluorescent lamps.



DAY-BRITE FIXTURES ARE AVAILABLE THROUGH ALL LEADING SUPPLY HOUSES

DayBrite

DAY-BRITE LIGHTING, INC.

5421 Bulwer Ave.

St. Louis, Missouri

Electrical Contracting, August 1939

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Going Back To The Job Costs You Money & Business

Eliminate this by installing control equipment that is made to stand the gaff and to render trouble free service day in and day out.

SAUTER

Time  Switches
with the "Astronomic" Dial

are made to be installed and forgotten due to the particular care taken to insure minimum wear of SAUTER clock movements (the most important factor in accurate and unfailing automatic operation of time switches).

Write for new, revealing time switch information today.

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Wires and Cables

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WIRES AND CABLES

G-E Deltabeston asbestos-insulated wires and cables are particularly designed for all applications where resistance to heat, acids, gas fumes, oil, corrosion or abrasion is important. The line includes asbestos-insulated power cable, boiler room wire, control cable, switchboard wire, rheostat wire, magnet wire, etc. Deltaglass glass-insulated magnet wire is also available.

For further information, see the nearest G-E Merchandise Distributor or Graybar Electric Company, or write to Section KM-691, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC



MULTI FLUORESCENT LAMP FIXTURES

This new unit gives you more
installation opportunities

Where soft daylight is desirable, this new fixture fits in perfectly for installations such as printing shops for proof-reading and typesetting, in matching colors, or inspecting metallic parts of varying degrees of brightness.

The basic unit shown can be made to fill many individual requirements. Two or more basic units can be joined where a high lighting intensity is desired. Where a sectional line fixture is wanted interchangeable end sections may be used with basic unit. Units have aluminum bronze finish and alzac aluminum reflectors. Let us send you bulletins giving installation and construction details.

MULTI
ELECTRICAL MANUFACTURING CO.
1840 W. 14th ST., CHICAGO, ILL.



[FROM PAGE 46]

LIGHTING A MACHINE SHOP

This machine shop is temporarily equipped with two different general lighting systems; a Glassteel Diffuser installation and the new Silvered Bowl Diffuser unit. Actually, the Silvered Bowl system delivers more light on the working plane than the Glassteel Diffuser installation, is easier maintained, and less glaring when viewed from



GLASSTEEL DIFFUSER gives lower surface brightness, softer shadows on the work and less reflected glare.

wide angles. However, at some angles the Glassteel Diffuser has a lower surface brightness than the Silvered Bowl unit, also shadows on the work plane are softer and reflected glare reduced.

Supplementary lighting units are also used in this machine shop. The units are equipped with 60-watt lamps and provide approximately 250 footcandles over restricted areas where the seeing task is critical.



SOUTHERN STREAMLINES — One of the first large installations in the south of "Zeon" fluorescent gas tubing will provide illumination for this new gasoline station in Miami Beach, Florida. Located near the Miami Beach end of the busy Fifth Street causeway to Miami, amidst a group of brightly lighted competitors, this station's linear light sources show up in sharp contrast. Wiring for this station was installed by the B & W Electric Company.

Electrical Contracting, August 1939

Why Is Youngstown The Largest Manufacturer Of Conduit In America? - - -

You men who buy and use Buckeye Conduit know the answer! You know it in terms of fast installation and uniform performance when working a series of bends with the hickey. You know what no back lash means to a man trying hard for a neat job. You know what time and money are saved when threads come clean on the first cut and need no chasing. But do you know why Youngstown Conduit does all these things? The answer lies in control -- of a

specialty. We make hundreds of tons of conduit, but we treat it as the particular product it should be. The ore is especially selected at our own mines. Processing is as careful as for the most difficult alloys. Inspection at every possible point in our mills gives you the performance on the job that you know you can count on with Buckeye Conduit. Buy Youngstown Buckeye Conduit -- to make faster time, to keep up schedules, to make more money on your contracts.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

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Ask your distributor for Youngstown Conduit - Pipe and Tubular Products - Sheets - Plates - Tin Plate - Bars - Rods - Wire - Nails - Tie Plates and Spikes

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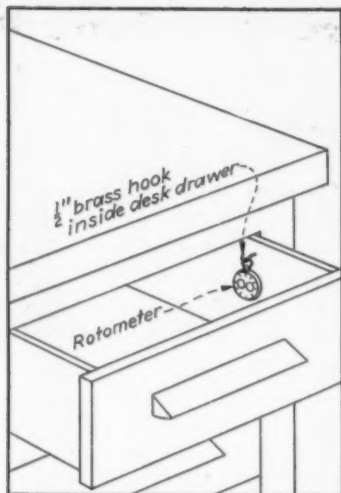


YOUNGSTOWN

Estimating

ROTOMETER TROUBLE

Rotometer crystals always manage to break at the most inconvenient time. Your jeweler can replace the glass with an unbreakable flexible material like celluloid at a cost of about 50 cents and will eliminate these annoying ac-



ROTOMETER HOOK inside the desk drawer keeps this fragile instrument handy and safe.

cidents. These "unbreakable" crystals scratch quite easily but with a little extra care their life may be prolonged indefinitely. When not in use hang the rotometer on a hook at the side of the drafting table or inside a desk drawer.

WHEN INTERRUPTED

When interrupted in the middle of running off the branch circuit conduit or counting duplex receptacles the estimator can usually find where he left off by his check marks. But the rotometer reading or tally-meter count may

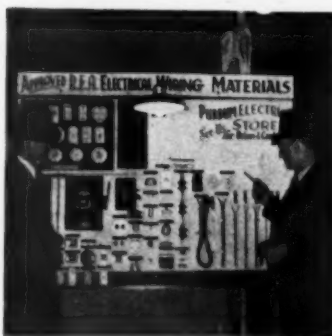
have been accidentally or carelessly changed or reset by someone else during the estimator's absence.

To guard against this, sweep a circle with the checking pencil on the plan, jot down the meter reading and the material being measured or counted and lay the meter in the center of the circle. This serves as a warning to others not to disturb the instrument and a reminder to the estimator that the figure has not been recorded on the estimate sheet.

FARM WIRING PRICES

Much discussion among estimators these days concerns the cost of farm wiring on rural cooperative lines. Few big town contractors have gone into this field and few rural electricians have conducted any time studies of this type of work.

However, the following farm wiring data is typical of Middlewestern proj-



RURAL WIRING specialist Charles Purdum, (right) Purdum Electric Store, Macomb, Illinois, cooperates with REA promotion by setting up display boards and explaining the advantages of quality in material to all comers.

When folks ask advice on how to do their own wiring he tells them, but he uses all the technical terms he can crowd in and carefully points out how expensive it is going to be for them if the inspector turns down the job. He usually gets the wiring order.

ects. It is taken from an Illinois experience. The unit price includes material and labor for the complete installation.

Approved W. P. Service Cable—Service Entrances

- 2 #8-15' cable, 30 amp fused—2 branch circuits—\$8.00.
- 3 #8-15' cable, 30 amp fused—4 branch circuits—\$12.00.
- 3 #6-15' cable, 60 amp. fused—Range and 4 branch circuits—\$16.50.
- 3 #6-15' cable, 60 amp multibreaker—4 branch circuits—\$19.00.
- (25 cents for each additional ft. of cable)

Outbuilding Services

- 2 #10 and smaller—\$2.50.

Yard Pole Meter Loops

- 3 #6 A W G—\$13.50.
- 3 #4 A W G—\$15.00.
- 3 #2 A W G—\$18.00.

House Wiring—Non-Metallic Sheathed Cable

- Ceiling and side wall outlets, inside and out—\$1.75.
- Switch outlet, s.p. switch and plate—\$2.00.
- Switch outlet, 3 way switch and plate—\$2.35.
- Duplex receptacles and plate—\$1.85.
- Electric range outlets with 20' cable—\$8.50.
- Bell transformer and bell—\$4.50.

Outbuilding Wiring—Non-Metallic Sheathed Cable

- Light outlets—\$1.80.
- Surface type switch outlets—\$1.75.
- Convenience outlets—\$1.75.
- Hay mow light—\$3.50.
- Yard light and switch, 2-3 way—\$7.95.
- Yard light and switch s.p.—\$4.95.
- Water pump outlets—\$4.00.
- Portable utility motor outlets 1 hp. 20' cable—\$3.50.
- Portable utility motor outlets 3 hp. 20' cable—\$4.00.
- Portable utility motor outlets 5 hp. 20' cable—\$5.00.
- Stationary motor outlets 1 hp. 20' cable—\$5.00.
- Stationary motor outlets 3 hp. 20' cable—\$5.50.
- Stationary motor outlets 5 hp. 20' cable—\$6.50.

Outside Wiring—Weather Proof Wire

- #10 w.p. wire in place per ft.—.03.
- #8 w.p. wire in place per ft.—.04.
- #6 w.p. wire in place per ft.—.05.
- #4 w.p. wire in place per ft.—.08.

Estimating at cost price on each job and adding a mark-up is not generally

Electrical Contracting, August 1939

You sell for profit



WHEN YOU INSTALL A SANGAMO TIME-SWITCH

Actuated by a cam, the "on" and "off" operations of an astronomic time-switch can vary automatically each day in accordance with actual sunset and sunrise time. To test the accuracy of this cam, each and every Sangamo Astronomic Time-Switch is placed in a specially developed machine which makes a graphic chart of the sunset



Form KAZ Astronomic Time-Switch

and sunrise curve (illustrated on insert). This is but one of a series of inspections all Sangamo Astronomic Time-Switches must pass—your guarantee that you sell for profit, which will not have to be shared by the necessity of service calls later, when you decide on a Sangamo Switch for your next installation.

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Here's all
there is to do!



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Perfect Joint
CONNECTORS

Approved by Underwriters

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Conduit $\frac{3}{8}$ "— $2\frac{1}{2}$ "

Cable to $2\frac{1}{8}$ " (with Bushings)

Cadmium and Everdur

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Sizes from .250" O.D. Tubing
to $1\frac{1}{4}$ " conduit.

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Estimating

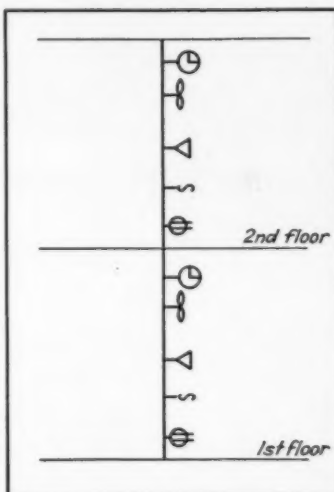
[FROM PAGE 50]

practiced on rural work. Estimators use a retail price schedule like the above for everything but very unusual jobs. The prices represent material, labor at 50 cents an hr. plus a mark-up varying from 20 to 25 per cent.

Basic parts of the wiring such as minimum service, ceiling, switch and receptacle outlets have the thinner margin. Extra capacity service, range outlets and out-building wiring have a somewhat larger spread.

VERTICAL SCALES

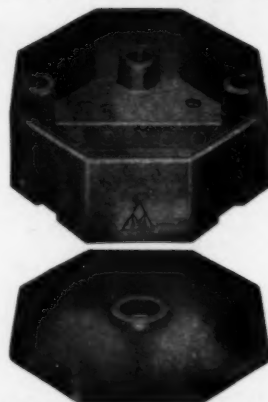
On layouts involving ordinary ceiling heights, skilled estimators frequently accumulate the vertical stubs to switches and plug receptacles by over-running the outlet symbol a distance equivalent to the stub. For greater accuracy on



VERTICAL CONDUIT scale sketches on blueprint with wall outlet heights marked to scale is an accurate and convenient rotometer run for measuring vertical stubs.

standard ceiling heights and convenience on unusual vertical dimensions, draw a line with the checking pencil at the side of the plan and mark in the wall outlet heights to scale. Instead of over-running the outlet the rotometer can be shifted over to this line and the vertical runs accurately measured. It takes no longer to make the run and in the end it may amount to a lot of wire and pipe.

Profit by USING **ILLINOIS** Dependable Porcelain **OUTLET BOXES**



Blazed and unblazed styles conforming to an existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency. Contractors who use these products not only establish themselves most accurately with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

CHOOSE G-E WIRING DEVICES



The Line Is Complete—
Lampholders, Convenience Outlets,
Attachment Plugs, Fuses, Cutouts,
Switches, Etc.

You will find every sort of wiring device you may need in the G-E line. These devices are designed for easy installation and for long dependable service. Their quality is uniformly high.

For further information, see the nearest G-E Merchandise Distributor or write to Section KM-691, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

Light
comes to
**TREASURE
ISLAND**

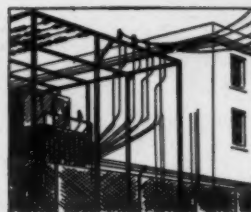
through **AMARINE Non-Leaded
Submarine Cables**

NEW heights in the art of illumination have been attained at the Golden Gate International Exposition. First to be perceived by the visitor, and perhaps last to be forgotten, are the novel lighting effects. These are dependent upon electrical energy—energy carried to the Island by *Amarine* non-leaded submarine cables, laid beneath the waters of San Francisco bay.

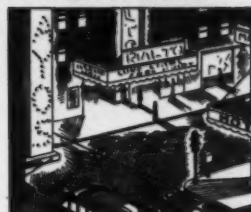
Each cable is composed of three stranded copper conductors, insulated with *Amarine*-40 rubber compound for service at 11,000 volts. Armored with heavily galvanized steel wires, it has an outer diameter of more than 4 inches and weighs 18

pounds per foot. Each conductor of the shore end is shielded with tinned copper tape. A thin layer of semi-conducting material, applied between rubber insulation and copper tape and in intimate contact with both, assures positive and permanent shielding.

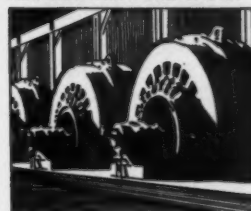
The new cables, installed in 1938, lie not far from two other *Amarine* non-leaded submarine cables that were installed in the same bay 16 years ago, and which are still in good condition and giving satisfactory service.



PAPER INSULATED CABLES



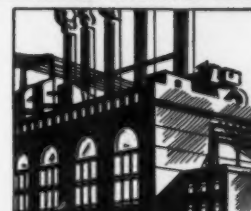
AMARINE NETWORK CABLES



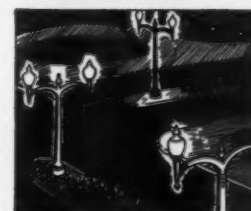
VARNISHED CAMBRIC CABLES



RELiance WEATHERPROOF WIRES



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AMERICAN STEEL & WIRE COMPANY

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Columbia Steel Company, San Francisco. Pacific Coast Distributors

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UNITED STATES STEEL

In the News

COUNCIL OF INDUSTRIAL RELATIONS RESUMES

Action by the Executive Committee of the National Electrical Contractors Association at its recent Hot Springs meeting re-established NECA's sponsorship of the Council for Industrial Relations. The Council will shortly resume its activities as a court of arbitration for the electrical construction industry.

As before, the Council will operate under the chairmanship of Louis K. Comstock, chairman of the board of L. K. Comstock & Company of New York. Its membership will be appointed by NECA to represent the employer and by the International Brotherhood of Electrical Workers to represent the employees. The membership of the Council who will sit as a court has not yet been announced.

The Council operated over a period of twelve years from 1920 to 1932. From 1920 to 1930 it was sponsored in behalf of the employers by NECA, but at that time NECA discontinued its labor section and withdrew from all activities concerning labor relations, and therefore its sponsorship of the Council ceased. The Electrical Guild thereupon became sponsor for the Council, but it continued only two years before the dissolution of the Guild. Thereupon, the Council, lacking industry sponsorship became inactive. During the period of its operation, however, the electrical construction industry was free from strikes.

The constituent membership of NECA, represented in the NECA Labor Relations Committee now numbers more than a thousand electrical contractors, all employers of IBEW journeymen and helpers. Approximately 300 contractors have joined NECA since the new Labor Relations Committee was established last year, under the chairmanship of E. C. Carlson of Youngstown.

NEW A/W COMMITTEEMEN

The National Adequate Wiring Bureau announces the appointment of these new members to its Executive and Plan Committees:

On the Executive Committee, H. E. Dexter, vice president, Central Hudson Gas & Electric Corp., replaces M. E. Skinner, R. H. Fite, Jr., Ebasco Services, Inc., replaces C. A. Eastman; and Ralph Neumuller, executive vice president, Electrical & Gas Association, Inc., New York, replaces George R. Conover.

Appointees to the Plan Committee are G. W. Hart, Ebasco Services, Inc., re-

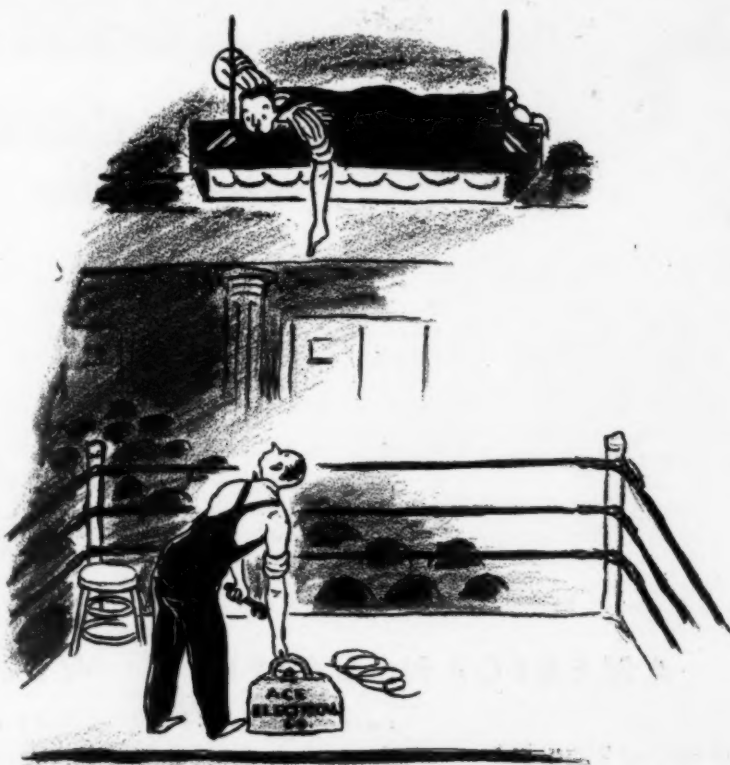
placing Mr. Eastman; and S. G. Hibben, director of applied lighting, Westinghouse Lamp Division, Westinghouse Electric & Manufacturing Company, replacing J. F. O'Brien.

ILLINOIS-WISCONSIN INSPECTORS FOR TWO CODE CHANGES

Wisconsin and Illinois chapters, International Association of Electrical Inspectors meeting at Delavan Lake, Wisconsin, on June 29-30, discussed EEI proposals for changes in the National Electric Code.

Speakers found several points of general agreement. Arguments were devoted principally toward limiting the application of the proposals. This was in sharp contrast to the previous inclination to reject the entire group of light and power group proposals.

In a committee report for the Illinois Chapter, Dave Talbot expressed the committee's opinion that thin walled insulation and bare neutral be approved but limited to existing raceways in existing buildings, providing that all conductors of the circuit are replaced. A. J. McGivern speaking for the electrical wholesalers suggested the approval of thin walled insulation wire in existing buildings and trial installations of bare neutral.



"You go on home—I'm staying for the fight."

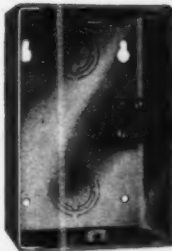
You're Going
to TOWN!



with these *New*
TYPE "MO"
COLT MULTI-BREAKERS



Surface cover with
Type "MO" Unit
attached.



Box ready for instal-
lation with Grounded
Neutral.

and here's why...

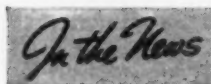
these New Type "MO" COLT MULTI-BREAKERS are the very latest thing in circuit breaker design. They are rugged in construction . . . designed for today's small home, farm and industrial requirements. They provide circuit protection that is entirely automatic . . . absolutely safe. They are inexpensive to buy . . . easy to install. Flush or surface cabinets with Grounded or Insulated Neutral. 15, 20 or 25 ampere capacities. Overall size is only 6 1/8" high by 4" wide.

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COLT'S PATENT FIRE ARMS MFG. CO., HARTFORD, CONN.
ELECTRICAL DIVISION



[FROM PAGE 54]

George Andrae of Milwaukee speaking for the contractors, expressed approval of thin walled insulated wire for existing buildings but opposed bare neutral in any form. All speakers insisted that in no case should these recommendations be applied to new buildings or major alteration jobs where existing methods of wiring are economically feasible.

Henry J. Morton of the Association of Edison Illuminating Companies outlined the position of the light and power groups in backing the proposals. He explained that the intent of the proposals was to open up work in existing structures.

REGIONAL A/W CONFERENCES COMING

San Francisco will hold a regional conference on adequate wiring on August 17 and 18. The National Adequate Wiring Bureau announces that subsequent conferences will be held in the southeast, southwest, the middle Atlantic and east-north-central sections.

The purpose is to give the local A/W Bureaus of each region an opportunity to exchange experiences. Topics to be discussed will embrace—how to organize local wiring promotion, including home shows, special displays, publicity, radio broadcasting



BIG GUNS—C. J. Cannon of Nimmo Electric Co., Detroit, and J. M. Pilmer of Electrical Engineering and Construction Co., Des Moines, the newly elected president of NISA, lingered after the meeting and here's what the prowling photographer perpetrated.

and other advertising; effective certification procedure; local field work; approaching the builder and architect; solving problems of rewiring; and how to make the program profitable to contractors and other industry branches.

NEWS ABOUT NECA

The mid-summer meeting of the NECA Executive Committee was held at Hot Springs, Va., during the week of July 10th.

Representatives of the Edison Electric Institute—E. A. Brand, chairman of the EEI Wiring Committee, O. K. Coleman, of the American Gas & Electric Company and Henry J. Morton of the EEI, staff—explained the purpose of the EEI proposals for changes in the national Electrical Code as seeking to open up new markets through the removal of physical and economic obstacles. They stated that the major group of the EEI proposals are directed to the re-wiring markets and not to the new wiring field.

It was the opinion of the executive committee that any standards of wiring which are allowed for old buildings can not be kept out of new buildings. NECA is opposed to the use of bare (uninsulated) neutral conductors. The committee believes that the new developments of thin wall insulation will meet all practical requirements for increased capacity in existing conduit installations, without the lowering of standards of protection to life and property assured by the fully insulated wiring system.

But the executive committee held that NECA should get back of any sound proposals which will open up new markets, promote added wiring business and prevent the diverting of the contractors' business to other channels, and that the re-wiring of existing buildings holds the major opportunity today. It was the consensus of opinion that this conference with the representatives of the Edison Electric Institute emphasized the need for groups of the industry getting together and considering the best interests of each group before any one group goes out to promote a program that may disregard or attack the interests of another group.

Attack on Building Industry

The Executive Committee voted to protest to the Temporary National Economic Committee the unsupported charges which have been made by Thurman Arnold, of the Anti-Trust Division of the Department of Justice, in his announcement of a drive against all branches of the industry. This breaks down public confidence and retards the greatly needed national building program. The Executive Committee offered to the TNEC its full cooperation in determining the true facts in the electrical contracting branch of the building industry.

Secretaries' Conference

It was decided to provide facilities at the National Convention in October so



LIVE-WIRE Ed Winkler, electrical maintenance engineer of Armour Auxiliaries, Inc., and President of the Chicago Electrical Maintenance Engineers division of the Chicago Electrical Association acted as Master of Ceremonies in the organization's annual dinner-dance in Chicago.

that secretaries and managers of local chapters and associations attending the convention may meet together in conferences during the convention.

San Francisco Chapter

Former President Clyde L. Chamblin of San Francisco, a guest of the Executive Committee at the meeting, presented 100 applications for new memberships from the San Francisco Electrical Contractors Association. This completes the membership in NECA for the 118 members of his local association. The San Francisco Chapter becomes the largest local chapter in number of members in the country.

Resigns as Vice President

Ralph M. Walker, Vice President of NECA, tendered his resignation as vice-president and as a member of the various committees on which he has served, due to the changed condition in the structure of his company which has withdrawn from the contracting business and is now engaged only in manufacturing. Mr. Walker's resignation was accepted by the Executive Committee with utmost regret and the recording of their deep appreciation for his great service to the industry.

Labor Relations Committee

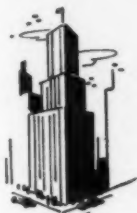
Preceding the three days meeting of the NECA Executive Committee the Labor Relations Committee held two days of conferences. D. W. Tracy, International President of the IBEW, met with them for one day.

"BASIC FACTORS OF ADEQUATE WIRING"

The Wiring Committee of the Edison Electric Institute has just issued a booklet—"Basic Factors of Adequate Wiring." In its covering letter to power companies, EEI says—"Inadequacy in wiring and the cost of correcting it has become one of

HERE ARE SOME OF YOUR PROSPECTS

For Automatic Electric Interior Telephone Systems



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FACTORIES



SCHOOLS



HOMES

Business houses, industrial plants, institutions, public buildings, residences—all these and many others make up your market for Automatic Electric private interior telephone systems. Such prospects—conscious of the time-saving and step-saving advantages of fast interior communication—are ready to buy—or are already buying. Get your share of this profitable business. Sell Automatic Electric private telephone systems. We'll help you.

Automatic Electric, originators of the automatic telephone, has been making both public and private systems for fifty years. We show here four of the many types of private systems available. Our field representative in your territory will be pleased to supply you with literature, prices and discounts as well as to work with you on particular jobs. Telephone him for full information.

[Automatic Electric Intercommunicating Systems are designed for private service. They cannot be connected with the public telephone system.]

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Attractively priced common-talking systems in capacities of two to ten stations. Conveniently packaged, simple to install. Operate from dry cells.

AUTO-COMS

Deluxe intercom. systems providing selective talking and selective signaling service for a maximum of ten stations, and up to five connections at one time. No switchboard needed.

INTERCOMS

Common-talking, selective-ringing systems in capacities of two to eleven stations. Beautifully designed and durably constructed for long, faithful service. Operate from dry cells or battery eliminators.

P-A-X's

Private Automatic Exchange systems, available in all capacities. Use standard automatic telephones and provide for a variety of special communication services.



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PRIVATE INTERIOR TELEPHONE SYSTEMS

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Electrical Contracting, August 1939

57

The easiest way to get ahead in electricity—
through the other man's experience as found in books



Whatever "getting ahead" means to you as an individual, there is no principle so important as backing up your brain with the other man's experience. Why spend time and effort to find out what has already been learned and put down for all to see in books? Here, for instance, are all the results of a rich experience in every stage of wiring, installation and contracting work gathered and set down for you in

Terrell Croft's AMERICAN ELECTRICIANS' LIBRARY

(6 volumes—over 2,800 pages—fully illustrated)

In six really magnificent volumes this library gives the most thorough, more complete and easiest-to-understand treatment of the more specialized phases of electrical practice in print today.

"How" and "why" for Maintenance Men
The books show the best ways to make installations for every type of conduit wiring job—they tell how to handle every kind of lighting and switch problem—they give tips on shortcuts for saving time on routine jobs—they show the quickest and surest methods of locating and remedying circuit troubles. Alternating current armature winding, electrical machinery control diagrams and machinery erection are some of the things covered in detail.

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In all, these books contain more than 1,000 clear, easy to follow diagrams, with wiring instructions written in simple language. It is unnecessary to tell you how valuable is this one feature alone.

Small monthly payments

You may examine these books for 10 days by sending the coupon below, filled out. In addition, if you decide to keep the books you have the privilege of paying for them in easy monthly installments while you use the books. Make sure you are not passing up your best bet for getting ahead. Mail the coupon today.

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Send me Croft's American Electricians' Library, 6 volumes, for 10 days' free examination. If I find the books satisfactory, I will send you \$1.50 in 10 days, and \$2.00 a month until \$17.50 has been paid. Other wise I will return the books postpaid.

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Position

(Books sent on approval in U. S. and Canada only.)



[FROM PAGE 56]

our major load building problems. After several years of research and discussion, the Wiring Committee is ready to offer a practical solution."

The booklet is interestingly written and well illustrated. It urges—

1. Rapid use of the new wiring materials and methods that have been developed.

2. More aggressive promotion of adequate wiring.

It makes the points that—

3. Load building is seriously handicapped by lack of copper capacity.

4. Fuse failures on customers' circuits are increasing very rapidly.

5. Operating costs are increased because it is necessary constantly to replace fuses for customers.

6. Undersized copper introduces low voltage with all its undesirable features.

7. Customers suffer inconvenience and dissatisfaction.

The committee says that "more emphasis should be placed on greater proportions of copper compared with insulation and mechanical protection," and analyzes the copper content of six approved wiring systems. It reports that surveys show 25 outlets in average houses wired in conduit, whereas 45 outlets are found when armored cable or non-metallic sheath cable is used. The cities surveyed are not named.

Covered neutral wiring, with load centers, is recommended for house wiring. For commercial buildings, they advocate the use of wires with thin wall insulation, the larger utilization of the space within conduits, increased continuous current-carrying capacity for conductors, and an uninsulated common neutral return wire.

The committee urges that wiring education within the industry be undertaken on a much increased scale. Two further booklets are coming, one to be called—"Covered Neutral Cable Helps Sell Adequate House Wiring," and the other—"Commercial Building Rewiring Market."

PACIFIC COAST PROMOTION PLAN

The Pacific Coast Electrical Bureau, Northern Division has been reorganized as a trade promotional agency, eventually to serve all Northern California. It will operate as an autonomous, self-governing local organization rather than a state-wide organization as in the past. The initial effort will be directed at commercial, industrial and residential lighting and wiring. George W. Barker is manager.

MINNESOTA STATE BOARD GROWS

The Minnesota State Board of Electricity announced the appointment of an additional field representative. A. Everling former contractor of New Ulm, will

take over the Southwestern Minnesota territory. Other field representatives are; Charles Turner, Southeastern Minnesota; W. H. Hackett, Twin Cities and Central area; Roy Nelson, Northern area.

The Minnesota State Board of Electricity supervises electrical contractor licensing and state electrical inspection.

PHILADELPHIA EXHIBITION ASSURED

Advance reports on the coming NECA convention in Philadelphia, Oct. 9-12, disclose that a large exhibit of manufactured products will be featured. To date 75 percent of the exhibit space has been sold.

The Electrical Constructors of Philadelphia, Inc. will be the hosts at the Bellevue-Stratford Hotel. W. Edward Frazer, chairman of the exhibition, promises an interesting convention program. And as a further inducement they offer the New York World's Fair.

COMING MEETINGS

Illuminating Engineering Society—Annual Convention, San Francisco, Calif., August 21-25.

International Association of Electrical Inspectors—Northwestern and Southwestern Sections Joint meeting, Empire Hotel, San Francisco, Calif., August 14-16; Western Section, Hamilton, Ont., Sept. 11-15; Southern Section, Asheville, N. C., Sept. 18-22; Eastern Section, Providence, R. I., Oct. 2-6.

National Electrical Contractors Association—Annual Convention, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 9-12.

National Electrical Manufacturers Association—Annual Conference, Palmer House, Chicago, Oct. 23-27.

ADEQUATE WIRING PROGRESS

St. Louis—The Adequate Wiring Bureau in St. Louis has set up a continuing plan of adequate wiring promotion aimed at the new home field. It will enlist the cooperation of architects, financing agencies and the building industry, through the recently organized "Supervised Home Service Construction", set up by members of the St. Louis Chapter of the A.I.A., a dozen responsible banks, trust companies, saving and loan associations, and other financing agencies, and the manufacturers of building equipment and materials. This will assure the buyer a well-designed home, soundly financed, properly constructed of good materials, inspected during construction. The Union Electric Company has taken a substantial membership in the organization on condition that the plans for every home include adequate wiring.

The local wiring promotion will include direct mail to prospective homebuilders, cooperative advertising with builders and extensive use of the National Adequate Wiring Bureau's materials. It will operate through an office and field organization.

The Bureau will be supervised by the St. Louis Electrical Board of Trade.

Baltimore—Some 20,000 school children

Electrical Contracting, August 1939

have been shown the advantage of adequate wiring in the home through the adequate wiring cabinet designed by the Consolidated Gas Electric Light & Power Company. It has been on display during the past two months in the Junior and Senior High Schools in that city. The exhibit visited fifteen schools and remained from two to four days in each. In most schools, it was utilized by the Science Classes and for general exhibition purposes. In some of the schools, it was part of the school exhibit open to the public.

Philadelphia—Sponsored by The Electric Association of Philadelphia, an effective adequate wiring exhibit was displayed at the premier showing of television at the Franklin Institute. The exhibit was open for approximately one month. Qualified attendants were on hand at all times. More than 50,000 persons attended.

MINNESOTANS MEET AT ALEXANDRIA

The 12th annual summer conference of the Minnesota electrical associations at Alexandria, July 22 and 23, brought together more than 150 electrical men.

The meeting opened as usual with a Board of Directors conference headed by Louis Gordon, Secretary Manager Wm. A. Ritt reported an apprentice indenture plan being organized by the State Industrial Commission. The Minnesota Electrical Council is cooperating.

At the Sunday afternoon conference under Ed Karst of Fergus Falls, A. H. Kessler, of the North Central Associated Electrical Industries outlined a plan whereby retailers trade associations will promote better lighting. Lighting layouts for merchants will be prepared at a central office.

Proposed changes in the National Electrical Code affecting farm wiring, service clearances, mounting of moisture proof equipment and non-metallic boxes were presented by Glenn Rowell, Electrical Engineer of the Fire Underwriters Inspection Bureau.

Geo. R. Jones and George Garney of the State Board of Electricity held a question and answer session on state law problems, and interpretations. They reported that it is now possible to get a state inspector to any part of the state within five hours.

The winter meeting of the Association will be held in St. Paul in February.

MANUFACTURERS NEWS

Goodrich Electric Co. of Chicago has appointed G. A. Fischer as manufacturer's sales agent, covering Indiana and Western Kentucky. Mr. Fischer is located at 608 Majestic Building, 47 S. Pennsylvania St., Indianapolis, Ind.

Westinghouse Electric & Manufacturing Co. announces the appointment of H. C. McDaniel to the commercial engineering staff of the Lamp Division. He was formerly a lighting specialist for Middle West and Pacific Coast public utility companies.



For new and rewiring jobs

ROME CABLE BUILDING WIRE

We manufacture code, intermediate, 30% and super aging.

All approved by the Underwriters Laboratories, Inc. N.E.C.S.

Flame and moisture resistant.
Slick finish for quick and easy pulling.
Long aging rubber.
Uniformly small diameters.
Clean—easy stripping.
Eight clear distinct colors.

ROME PRODUCTS

Hot rolled rods, bare and tinned copper wire, bare and tinned strand, U.R.C. weatherproof wire, cotton, paper and asbestos magnet wire, rubber insulated wires and cords, lead covered cables.

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New York, Chicago, Philadelphia, Pittsburgh, Richmond, Cleveland, Boston, Los Angeles.



STOP this with a MCGILL Adaptable Lamp Changer

Thousands of persons are killed or permanently injured each year in accidents while doing ordinary things. Climbing ladders to change lamps is a hazardous and needless task. A MCGILL Lamp Changer will do the trick without risk or danger to workmen. At the same time it reduces the costs for workmen's compensation insurance, and loss of time due to personal injury.

GO for Safety

Simplicity of construction and ease of operation of the MCGILL Lamp Changer may be likened to the human hand. The coil spring around the finger tips grips the lamp tightly and makes for much easier and quicker changing of lamp bulbs. A flexible joint is furnished for the smaller size lamp changer so that, by pulling the cord, the head is adjusted to any angle. This facilitates removal or insertion of lamps in sockets in almost any position. Steel or aluminum pole sections 5½ feet long are available, and fasten together with a locking arrangement to make poles any length up to 30 feet.



Order Today

MCGILL MANUFACTURING COMPANY

Box No. 670, VALPARAISO, IND.



[FROM PAGE 59]

General Electric Changes

H. L. Andrews, vice president of the General Electric Co., has taken charge of the appliance and merchandise department with headquarters in Bridgeport. He was formerly head of the Company's transportation activities. Mr. Andrews has been with G.E. for 29 years and has had a wide range of experience in engineering,



H. L. ANDREWS, vice president of G.E., now heads the appliance and merchandise department.

manufacturing and sales departments. Mr. Andrews will now be responsible for the Company's activities in the major and traffic appliances as well as construction materials.

The General Electric Vapor Lamp Co. of Hoboken, N. J. has been merged with the Incandescent Lamp Department of General Electric. Because of this change, the Incandescent Lamp Department will hereafter be known as the Lamp Department of the General Electric Co.

Cutler-Hammer, Inc. of Milwaukee has announced the appointment of B. M. Horter as general sales manager. He has been with Cutler-Hammer for 18 years. Mr. Horter was manager of the Resale Sales Dept.

Allis-Chalmers Mfg. Co. has combined its Phoenix, Ariz. and El Paso, Texas branch offices, into one district to be known as the El Paso District. J. B. Cooper, manager of the Phoenix Branch has retired and O. F. Metz becomes district manager of the combined new territory with offices at El Paso. H. H. Roth of Phoenix has been transferred to El Paso.

Electric Associates has just been organized to provide representation throughout the Rocky Mountain and Pacific Coast territory for the Reliance Electric and Engineering Co., and the Clark Controller Co. of Cleveland, Ohio and the Electric Machinery Manufacturing Co. of Minneapolis, Minn. The main office of the group for the Pacific Northwest will be at 73 Hawthorne Blvd., S.E., Portland, Oregon. L. F. Newton will be in charge.

Arrow-Hart & Hegeman Electric Co. has opened a new office and warehouse in Chicago. It is located at 155 West Monroe St. R. L. Wildauer is the manager of this branch.

American Engineering Co. of Philadelphia has announced the appointment of A. C. Cooper Sales Co., 200 E. 42d Street, New York City, as sales representatives for metropolitan New York, Long Island and Northern New Jersey.

T. B. Wood's Sons Co. has appointed the Arnold Electric Co., Arlington, Virginia, as one of its distributors.

Also the Hartley-Rose Belting Co. has been appointed to serve as its factory branch in Pittsburgh.

Ajax Flexible Coupling Co. of Westfield, N. Y. has appointed the Urquhart Service Co., 1501 Wynkoop St., Denver, Colo. and 417 Dooley Block, Salt Lake City, Utah, as sales representatives.

G.E. Lamp Department Promotions

The lamp department of General Electric Co., Nela Park, Cleveland, announces the promotion of four sales division executives.

L. R. Wilson, who for the past three years served as assistant manager of South Pacific Division, Los Angeles, becomes manager of North Pacific Division at Portland, Oregon.

Harold A. Olson, who for more than two years has served as manager of North Pacific Division, Portland, Oregon, leaves this division to become assistant manager of Atlantic Division, New York City.

R. B. Oliver, assistant to the manager of Atlantic Division, New York City, has been put in charge of all national and syndicated accounts originating in the New York area.

W. H. Robinson, Jr. is promoted to the assistant managership of South Pacific Division, the post left vacant by Mr. Wilson.



This Maintenance Clicks

Albany, New York, has some 30 schools, and one electrical contractor, Felix Hanzel, handles the electrical maintenance in all but three large high schools. The Hanzel Electric Company's crews keep costs down by knowing each school's problems thoroughly. As a result, the average order runs from one to three hours labor. This has been going on for fifteen years, so the school board must be satisfied with contractor maintenance.



OAKS FROM ACORNS—Voltage tests and lighting efficiency checkups strike pay dirt in the adequate commercial wiring field for the J. J. Donohue Electric Co. of Worcester, Mass. Mr. Donohue recently sold this 600 to 1,200-amp. service changeover to a local department store on the strength of these tests. He tests the voltage in the customer's presence, and then demonstrates the effect of correct voltage for lighting with boosters. Where voltage is low, the booster transformer is switched into the circuit. This method of showing how lighting effects are improved provides a strong argument for rewiring under-coppered systems.

Wants Fewer Wire Sizes

A recommendation that wire sizes numbers 14, 10, 6, 3, 2 and 200,000 cm be eliminated from ordinary wiring practice was made by the Committee on New Materials, Devices and Wiring Methods of the Kentucky Chapter, International Association of Electrical Inspectors in a recent report to the Western Section.

The committee suggests that this elimination will help reduce stock items and do away with wire sizes that are unnecessary. The report also states that the committee is convinced that the bare neutral system of wiring makes for a safe, simple, and economical wiring system, and urges the Western Section of the I.A.E.I. to sponsor its adoption.

Electrical Contracting, August 1939

He Makes It Pay

House wiring along North Carolina REA lines has become a specialty with Goodrum and Sons of Lexington, N. C. It is a family organization. J. F. Goodrum runs the shop, Mrs. Goodrum the office while the two sons and three more wiremen do the installing. Their standard price is \$5 for a one circuit service with not longer than 15 ft. of cable. Outlets in the house are \$1.85 each. Farm buildings are wired time and material. Yet Goodrum has competitors who quote \$1.50 an outlet. He wonders why.

Charter Member

The contracting firm of Hewitt & Warden of Newburgh, N. Y., displays with pride the first license issued in that city. An enlargement of Electrician's License No. 1, mounted on a back-board is hung in the firm's window.

Counterfeit Detector

Bank tellers report that counterfeit currency can be detected with amazing ease under daylight fluorescent lamps, according to Russ Hawkins of the Hawkins Electric Company of Springfield, Illinois. Several trial installations for bank screen lighting show good prospect for landing orders for complete installations.

Sign Service Precaution

Up New Hampshire way the cold weather makes gas tubing rather risky to handle on sign service calls. So when R. J. Sanborn of A. L. Franks & Co., in Manchester, takes a sign service order, tubing is handled at the owner's risk.



INDUSTRY DECENTRALIZATION is raising new problems in motor shop management says Al French of the French-Gerleman Electric Company of St. Louis, Mo. Metropolitan motor shops must be set up to operate over wide geographic areas and still give the customer service of high quality with reasonable speed.



BRANCHING OUT—It is news when contractors buy a wholesale business. In Oakland, Calif., two electrical contractors, Frank E. Boyd (seated left) and Walter D. Vance (standing), recently bought the Gilson Electrical Supply Co., oldest and one of the largest wholesale concerns in the East Bay district. Both men are known widely to the trade for their successful operation of Pacific Electric Motor Company, an electrical engineering and contracting organization. In the picture Henry I. England, former owner, is signing the sales agreement.

Qualified Part-time Inspections

Contractors in smaller cities want good inspection, but revenues are often too small to justify a qualified man being retained on full time. In Pawtucket, R. I., this situation was overcome by having the local power company's service inspector deputized to represent the city on a part-time basis. Since this work runs parallel in duties, it is possible to have a well qualified person handle inspections at reasonable cost to all parties concerned.

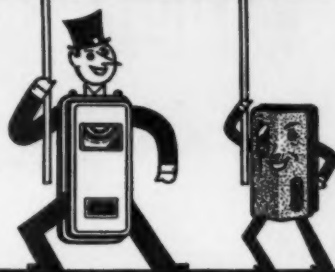
Motor Service Dragnet

Some folks look up the motor makers name when trouble hits their equipment, instead of the telephone listing of their local shop. So the Electric Motor Sales and Service Co. of Albany, N. Y., goes after motor service both ways. The company lists its address and telephone number in the classified directory for three makes of motors it has been authorized to service.

Why Records Pay

The contractor's job records often provide important safeguards, reports Arnold Kleiner of Newark, N. J. A lady sued her apartment house landlord for head injuries sustained from a falling fixture globe. It seems that the owner's liability and that of the electrical contractor depended on how long the fixture had been installed before the accident. Kleiner's work record, showing that the exact date and time of day of installing the fixture was three months before the accident occurred, cleared the issue. This owner appreciated having a systematic contractor do his work.

THE LEADING TIME SWITCH VALUE



PARAGON

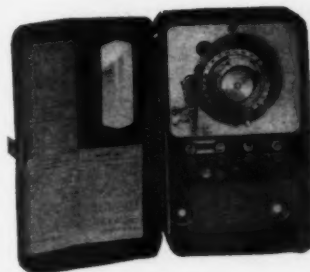
300 Series

TIME SWITCHES

Single Pole—Single Throw

Now Only

\$13.00!



Proven 100% Efficient for controlling:—

**Illuminated Signs
Store and Window Lights
Stokers—Oil Burners
Attic Fans—Blowers
Pumps—Motors—Etc.**

The Paragon 300 Series Time Switches have demonstrated, in thousands of installations of all kinds, their unequalled performance:—

**No Repairs No Breakdowns
No Failures No Servicing**

And they are the simplest, the easiest, and the lowest cost to install.

The 300 Series is a typical Paragon high quality instrument at a price now lower than makeshift devices.

**ASK YOUR ELECTRICAL
SUPPLY HOUSE**

For a Paragon #301 for \$13.00 List, or get Bulletin 3965E for full specifications.

PARAGON ELECTRIC CO.
37 W. Van Buren St., Chicago, Ill.

EQUIPMENT *News*

Junction Box

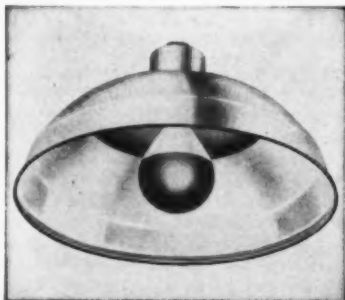
A new junction box, Catalog No. 629, for feeding "Plug-In" strip with any type of wiring material. Fits on any type of standard switch box or cover. Roughed into place in advance, it provides adjustment to assure proper alignment with "Plug-In" strip. Made for three types of "Plug-In" strip, concealed flush, baseboard cap and chair rail. National Electric Products Corp., Fulton Bldg., Pittsburgh, Pa.



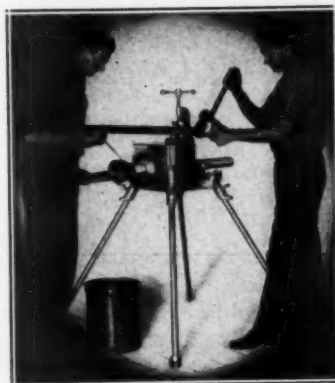
NATIONAL ELECTRIC JUNCTION BOX

Silvered Bowl Diffuser

RLM standard silver bowl diffuser designed for use with 300 or 500 watt silvered bowl lamps. Recommended for general lighting of low bay areas in machine shops, assembly departments, metal working shops, printing shops, textile mills and similar locations. Consists of a dome shaped porcelain-enameled reflector, an inner aluminum reflector and a socket assembly. Supplied either with Locklite hoods for both conduit and 4 inch outlet box mounting or as a one-piece unit for conduit mounting. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



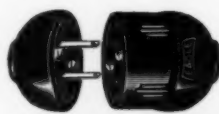
WESTINGHOUSE SILVERED BOWL DIFFUSER



BEAVER PIPE & BOLT MACHINE

Pipe & Bolt Machine

Model C portable pipe and bolt machine is designed for bench or stand use. Gears are enclosed. Large driving gear operates in a bath of oil, reducing friction, heat, noise and wear. Has conventional type geared chuck, which grips pipe from 1/8-in. to 2-in. and bolts from 1/4-in. up. Two men can work at same time—one threading, the other bending or making up fittings. Motor has 1/2 h.p. nominal rating. Choice of either 110 or 220 volt motor, reversible at switch. Beaver Pipe Tools, Warren, Ohio.



EAGLE JUMBO CONNECTOR

Connector

A jumbo rubber cord connector for portable lights, saws, floor scrapers, pumps and portable motor driven machines. Some of the features are—a half inch cord hole to permit heavy cable; two-screw fastening for rigid and permanent assembly; fibre disc with ample clearance to facilitate wiring; brass washers inserted in body screwholes for additional reinforcement and live rubber. Eagle Electric Mfg. Co., Inc., 59 Hall St., Brooklyn, N. Y.



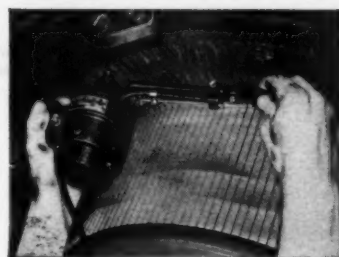
G. E. WEATHERPROOF LAMPHOLDER

Weatherproof Lampholders

A new small, all-rubber weatherproof lampholder has been developed. It is trim, neat in appearance and convenient to use. All-rubber jacket is equipped with a shadeholder groove, and tinned screw shell is enclosed in jacket so that it can neither turn nor come loose. There are no rivets to loosen and no pitch or cement to crack. Six-inch rubber leads supply current directly to shell and center. Terminal contacts are locked in rubber jacket and stay in place. General Electric Co., Bridgeport, Conn.

Portable Undercutter

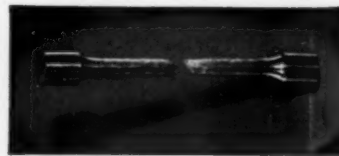
Portable mica undercutter No. 62 undercuts horizontal commutators up to 30-in. dia., flat commutators up to 11-in. dia. Motor is 110 volt Universal d.c. or 25 to 75 cycle a.c. Spindle can be replaced by unscrewing plate off gear case; pull gear out and replace spindle with new one. No flexible shafts. Hullhorst Micro Tool Co., Smead Ave., Toledo, Ohio.



HULLHORST MICA UNDERCUTTER

Electrodes

A complete line of steel electrodes known as "McKay Certified Stainless Electrodes." Each package contains certification of weld deposit analysis rather than wire analysis. Features are instant contact upon restriking arc, ease of slag removal, spatter free within practical limits, smooth bead with weld contour and all alloys contained in core wire. McKay Company, York, Pa.



McKAY STAINLESS ELECTRODES

This Teletalk System Was Sold at a PROFIT... and so was the Installation Material and Labor!



Below: Model 212-A with annunciator feature. In addition to communication with Model 110 at left, also permits communication with ten other stations

Above: Model 110 connected in system with Model 212-A shown at right—permits communication with eight other stations

WEBSTER ELECTRIC
Teletalk
REG. U.S. PAT. OFFICE



**enables contractors to make
a Profit in Three Ways!**

On every type of installation, the contractor handling Teletalk adds a profitable bill of materials and labor to his initial profit on a Teletalk system.

A partial list of materials required on a Teletalk job includes junction boxes, switch covers, electrical metallic tubing, EMT box connectors, interior telephone and insulated stranded wire.

Labor is a sizable item, as well.

Most of the business offices and industrial plants you are now dealing with are excellent prospects for Teletalk. Teletalk is the modern method of amplified inter-communication. It is adaptable to all types of

installations: offices, stores, homes, industrial plants, institutions. Because it has many features attractive to users, Teletalk is easy to sell. It is extensively advertised, and has met with wide acceptance. Sales helps designed for your use are available.

Write for complete details, now, and on your next job—profit *Three Ways* with Teletalk!

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WEBSTER ELECTRIC COMPANY, RACINE, WISCONSIN, U. S. A.
Export Dept.: 100 Varick St., New York
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Webster  **Electric**

"Where Quality is a Responsibility and Fair Dealing an Obligation"

SEE FOR YOURSELF

How wires are wedged fast—gripped *completely around* in the V-BOTTOM wire opening of



SOLDERLESS LUGS

Learn how fast you can make strong, neat solderless connections . . . with just your wrench, screw driver or pliers.

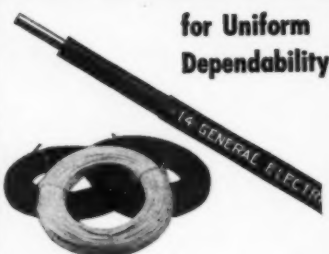
SEE ONE IN ACTION!

Write for Free sample—or better still, ask your Electrical Jobber for one.

DEPT. E C

IlSCO Copper Tube & Products, Inc.
5629 Madison Road, Cincinnati, Ohio

USE G-E BUILDING WIRE



for Uniform Dependability

G-E Building Wire can always be depended on. It is carefully manufactured for uniform high quality and enduring service. It is easy stripping, clean stripping and easy pulling. Diameters are uniformly small. Different colored braids make circuit testing easy. Uniform flame-retarding and moisture-resisting finish. Marked for quick identification.

For further information see the nearest G-E Merchandise Distributor or write to Section KM-691, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC



[FROM PAGE 42]

Attic Ventilators

These fans, called "Ventilattic" are for use in homes, stores, clubs, theatres and hotels. Fan is portable, equipped with grills for safety, housed in a cabinet treated with sound absorbing material. Has automatic belt tension device. Motor is equipped with thermal overload protection. Units are furnished in three sizes, 30-in., 36-in. and 42-in., with capacities varying from 5,500 CFM to 11,000 CFM. Peerless Electric Co., Warren, Ohio.



PEERLESS "VENTILATTIC" FAN



SQUARE D MULTI-BREAKER

Circuit Breaker

A new low-cost unit has been added to the Square D line of Multi-breakers for use in the small home, farm, small store and shop. This circuit breaker combines switching and over current protection. It will provide small homes or cottages with a service or load center for lighting and appliances, on the farm it can be used with grinders, milking machines, utility tools and in other locations where a disconnecting switch and over current protection is needed. In gasoline stations and small shops and stores it will replace more bulky 30 ampere a.c. type D general purpose safety switches.

Designated as type MO, it is available in 15, 20 and 25 ampere sizes for 115/230-volt single and two pole applications. The unit is 6½-in. high, 4-in. wide and 2½-in. deep and adapted to flush or surface mounting. No live parts exposed. Factory

calibrated and sealed, it will interrupt circuit under same overload conditions but will not open circuit during brief periods of high inrush current encountered in starting motors. Square D Company, 6060 Rivard St., Detroit, Mich.



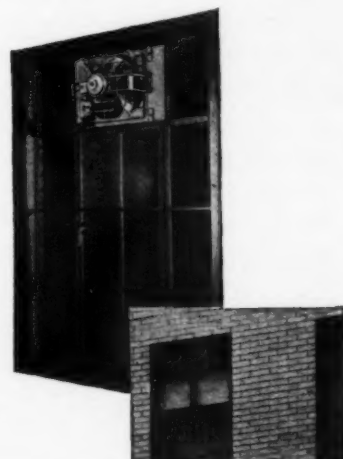
STERLING SQUIRREL CAGE MOTOR

Motors

A new line of small motors developed to simplify certain machine designs requiring frequent reversals in direction of rotation. Frame, shaft and bearings are of sturdy design. Stator windings are micabestos insulated. Rotor is high resistance. Stator and rotor windings are cooled with continuous forced ventilation by small auxiliary motor and squirrel cage fan at one end of motor. Available in a number of sizes and speeds up to 10 h.p. Sterling Electric Motors, Inc., Telegraph Road at Atlantic Blvd., Los Angeles, Calif.

Ventilating Fan

A ventilating fan designed for installation in steel casements. Has 10-in. fan blades that move air at rate of 600 c.f.m. Protective wire guard between motor and fan blades. Frame of steel, equipped with weather-proof shutters, operated from inside by latch cord to switch. Fan is equipped with totally enclosed motor. Occupies a window space two lights wide by one light high. Standard size panel of fan is 17½-in. wide by 11½-in. high. Signal Electric Mfg. Co., Menominee, Mich.



SIGNAL VENTILATING FAN



TRUMBULL "125" FLEX-A-POWER

Distribution System

No. "125" has been added to this line of Flex-A-Power, which is part of its feeder distribution systems. It is small in size and designed for use in small factories, work shops and garages where there are few machines, short runs and comparatively light connected load requirements. It comes in 10-ft. units and can be hung in position with special types of hangers. Available in 125 amp. capacity, in 2 and 3 pole construction for 575 volts or less. Connections to machines can be made by plugging in with "124" Flex-A-Plugs at any point on 12-inch centers. Also available in ratings—30 amp., 2 or 3 pole, 250 volt; convertible 30-60 amp., 2 or 3 pole, 250 and 575 volts. Trumbull Electric Mfg. Co., Plainville, Conn.



S & W DELAY-O-LITE SWITCH

Switch

A safety device for home owners is an adjustable toggle switch which permits light to stay on from 20 to 60 seconds after switch is snapped off. It is called the Delay-O-Lite and has been approved by the Underwriters Laboratories. It will fit standard switch boxes and resembles the ordinary wall type toggle switch. S & W Mfg. Co., Downey, California.

Fish Tape Reel

A new fish tape reel and puller designed to fit into an electrician's tool kit. Known as "Junior No. O", it combines three tools in one—a fish tape, a reel and a puller. It is 8½-in. in diameter, less than ½-in. wide and weighs 30 ounces, including 50 feet of ½-in. x 0.60-in. tape. Reel makes it possible to pull wire through conduit in one operation. Eliminates breakage. Prevents tape from springing over the job touching live wires, causing accidents. Ideal Commutator Dresser Co., 1041 Park Ave., Sycamore, Ill.



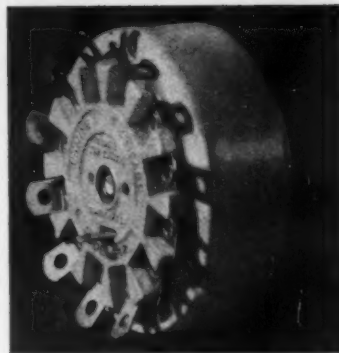
IDEAL FISH TAPE REEL

Tamres Fuses

Three new Tamres tamper-resisting plug fuses are now available with capacities of 15, 20, 25 or 30 amperes. Two adapters are available—regular or with a locking spring. Adapters are same diameter as Tamres fuse and screw into fuseholder ahead of fuse. If fuse is removed, adapter remains permanently secured in cutout and resists any tampering. Fuses can be used as an ordinary standard plug fuse without an adapter or as a tamper-resisting plug fuse with an adapter. General Electric Co., Bridgeport, Conn.



G. E. TAMRES FUSE



OHMITE TAP SWITCH

Tap Switch

Model 412-40 ampere tap switch is one of a new series of high amperage heavy-duty rotary multi-point selector tap switches. Provides a practical answer to circuit switching requirements for battery chargers, X-ray and diathermy equipment, tapped transformers, radio transmitters, arc welders, spot welders, ventilating fans, motor controls. Rated for 240 volt a.c. non-inductive circuit. It is 4-in. in diameter and equipped with maximum of 12 contacts. All-enclosed; all-porcelain construction; silver-to-silver contact; low contact resistance; simple, positive, cam and roller snap-action; back-of-panel mounting. Ohmite Manufacturing Co., 4835 Flournoy St., Chicago.



RELIANCE SPEED DRIVE

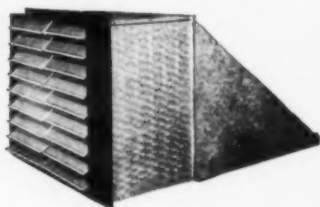
Adjustable-Speed Drive

An all-electric, a.c., small adjustable-speed drive has been developed. Consists of control unit and adjustable-speed motor, applied directly to machine to be driven. Speed control unit has been designed for use on three-phase, 60 cycle, 220, 440, and 550 volt a.c. circuits. Driving motor is a Reliance Type T. Can be supplied in a variety of types, including enclosed fan-cooled, splash-proof and explosion-proof. Gear motors may also be used. Motor can be started and stopped without interfering with speed setting. Quick stopping is obtained by regenerative braking. Reliance Electric & Engineering Co., Cleveland, Ohio.

[FROM PAGE 45]

Roof Ventilator

A new ventilator for installation on flat roofs designed to exhaust hot air from houses and stores. Exhaust fan is enclosed in weather-proof pent house of galvanized iron, with new automatic vertical shutter. Unit can be flashed to roof slab, with flanges provided for this purpose. Available in three sizes having capacities of 7500, 11500 and 16500 CFM. Viking Air Conditioning Corp., Main and Center Sts., N.W., Cleveland, Ohio.



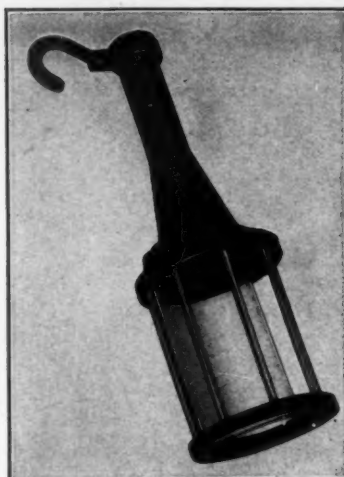
VIKING ROOF VENTILATOR

Control Stations

A new line of standard duty, Bulletin 800, push-button control stations are available in single-button and double-button types. Enclosure consists of reinforced bakelite cover mounted on die-cast frame. A conduit opening is provided at one end of die-cast frame. Mechanism is of unit type construction, which can be removed from frame. Double break, silver contacts are located in recessed chambers. A latch device can be provided for padlocking "Stop" button in its open position. Available in both horizontal and vertical arrangements. Maximum d.c. rating of 1 ampere, 115 volt; 0.5 ampere, 230 volt; 0.25 ampere, 550 volt. Maximum a.c. rating 3 ampere, 110-220-440-550 volt. Allen-Bradley Co., 1311 S. First St., Milwaukee, Wis.



ALLEN-BRADLEY CONTROL STATION



IPCO PORTABLE HAND LAMP

Portable Lamp

An insulated portable hand lamp recommended for many operations in electric generating plants and sub-stations, garages, battery rooms, steamships, railroad shops, telephone exchanges and all types of work and electrical inspection where a metal lamp guard constitutes a hazard. It is non-conductive. Eliminates shocks, short circuits to equipment. Takes standard or mill type lamps up to 60 watt. It is waterproof and heat resistant. Industrial Products Company, 800 W. Somerset St., Philadelphia, Pa.

TRICO FUSE
LEVEL OILER

Oiler

A new line of visible automatic constant level oilers, with unbreakable reservoirs and adjustment oil level features. Automatically maintains proper oil level in ring or ball bearings, gear and pump housings. One filling sufficient to lubricate a bearing three months or longer. Reservoir attached to lower casting by threaded spout, and removable for cleaning and refilling. Made in one, two, four and eight ounce capacities with all bottles interchangeable. Two styles for standard surge and high surge levels have side outlets only and also side and bottom outlets for bottom connection or for draining purposes. Trico Fuse Mfg. Co., Milwaukee, Wis.

Motor Starter

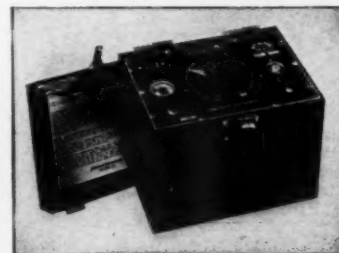
A new De-ion motor starter designed to control loom motors in the textile industry. Includes latest type toggle switch and a motor watchman for overload protection. A pre-formed bi-metallic disc trips contact. No thermal link to renew. Inverse time limit thermal overload provides time for starting and for heavy peak loads, yet fully protects motor. Line-starter has trip-free handle, which indicates all three positions of "on," "off," and "tripped." Front operation allows recessing in machinery or close banking. Other features are quick make and break, rust resisting parts, double break silver contacts, conduit knockouts in all sides and back. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



WESTINGHOUSE MOTOR STARTER

Instrument

A high resistance measuring instrument, Megabridge, Series MB, for routine insulation tests. Accurate yet simple to operate, compact and portable. Recommended for testing electrical equipment, radio components, waxes and oils, insulating materials of all kinds, leakage and moisture content. Operating from a.c. it has self-contained d.c. supply for bridge circuit and electron ray tube. It is housed in a walnut wood cabinet, 8-in. long, 7-in. high and 5½-in. deep. Shipped complete with separable power line cord, three test leads, one 6N5, one 1V and two voltage regulator tubes. Industrial Instruments, Inc., 162 West 23d St., Bayonne, N. J.



INDUSTRIAL INSTRUMENTS MEGABRIDGE

Air Recirculator

The Kisco "Deflecto" ceiling model air recirculator draws cool air up from floor and recirculates it outward and downward without drafts, blasts or noise. It does not disturb the hot, ceiling air. Several designs available with or without indirect lighting. Kisco Company, Inc., 39th and Chouteau, St. Louis, Mo.



KISCO AIR RECIRCULATOR

Switch Plate

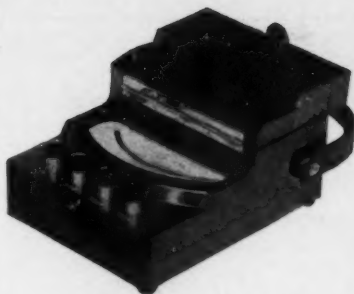
Combination electric Thermon-O-cator switch plates and thermometers. For use in homes, office buildings, public institutions, industrial plants, stores and warehouses. Calibrated for easy reading, with eye level scale that transforms a switch plate into an instrument. Electra Manufacturing Co., Red Hill, Pa.



ELECTRA THERMON-O-CATOR

Portable Instrument

To provide a direct-current companion for the Type AP-9 (a.c.) line, the Type DP-9 concentric-magnet instrument has been developed. It combines advantages of small case size, case styling and general convenience, with added features of mechanical simplicity, high sensitivity and magnetic shielding. In this element two sector-shaped Alnico magnets are ground to dimensions, placed inside a soft steel ring and then entire assembly is diecast together. With core and armature assembly supported in separate diecasting, design is essentially a two-unit construction with a removable core assembly and moving system. Available as a voltmeter, ammeter,



G. E. PORTABLE INSTRUMENT

millivoltmeter, milliammeter, microammeter, and thermocouple voltmeter. General Electric Co., Schenectady, N. Y.



WAKEFIELD COMMODORE UNIT

Lighting Fixtures

A new line of indirect lighting units, the White Commodore Series. With 15-in., 19-in., 23-in. and 26-in. reflectors to accommodate from 200 to 1,500 watt lamps. Hangers are made of aluminum. Reflectors are white plaskon. F. W. Wakefield Brass Company, Vermilion, Ohio.

Convenience Outlet

Twist-Tite convenience outlets use standard caps. Normal tension is provided when cap is plugged in straight. Maximum tension may be secured by twist of cap to right. Has double contact springs, "Clix-in" plate mounting, insulating barrier, large binding screws, wide mounting ears, anchored mounting strap. Bryant Electric Company, Bridgeport, Conn.



BRYANT CONVENIENCE OUTLET

CAPACITORS



For Any CAPACITOR-STARTING Motor

It's easy to replace broken-down capacitors in electric refrigerators. AEROVOX provides wall charts and catalogs listing all popular type motors and their required capacitor replacements.

Meanwhile, there is your local jobber who stocks AEROVOX capacitor replacements. So you lose no time when you use AEROVOX units.

Ask Your Jobber . . .

He'll give you our latest listing or chart . . . show you typical units . . . tell you about the new Capacitor Selector and Emergency Units for capacitor-start type motors—latest sure means of getting refrigerators going in a few minutes. Or write us direct.



Burndy SCRULLUGS

Have no loose parts to get lost!

ALL SCRULLUGS ARE TIN-PLATED

Type KPA

BURNDY
ENGINEERING CO., INC.
459 E. 133 Street, N. Y. C.

**SIMPLICITY AND
SPEED IN WIRING
GIVE TOPS IN PROFIT**

RE-MO-LITE



A SIMPLE EFFICIENT METHOD

RE-MO-LITE is helping lots of contractors to add considerably to their earnings. This modern, simple yard-light is the only remote controlled lighting unit on the market. It gives you a fine opportunity to meet rural as well as commercial and industrial needs with good profits. You save on material and labor because of the extreme simplicity of installing.

The RE-MO-LITE is controlled from a single-wire service and any number of switches can be used on the service. It costs no more—in fact less—than the old 3-way service. It comes complete with 2 switches, lag bolts, service screws, and instructions. Here is a yardlight that is convenient and safe. Ask about our SPECIAL PRICE FOR AUGUST.

Twentieth
CENTURY ENGINEERING CO.
MANKATO, MINNESOTA

USE G-E INSULATING MATERIALS



The Line Is Complete—
Friction and Rubber Tapes,
Varnishes, Varnished Cloth,
Unvarnished Cloth Tapes,
Solders, Glyptal Red, etc.

Power interruptions cause trouble and expense. That is why it is wise to use G-E Insulating Material. They protect power lines longer, save money and are truly dependable. They are the same materials that General Electric uses in the manufacture of its electrical products.

For further information, see the nearest G-E Merchandise Distributor or write to Section KM-691, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

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